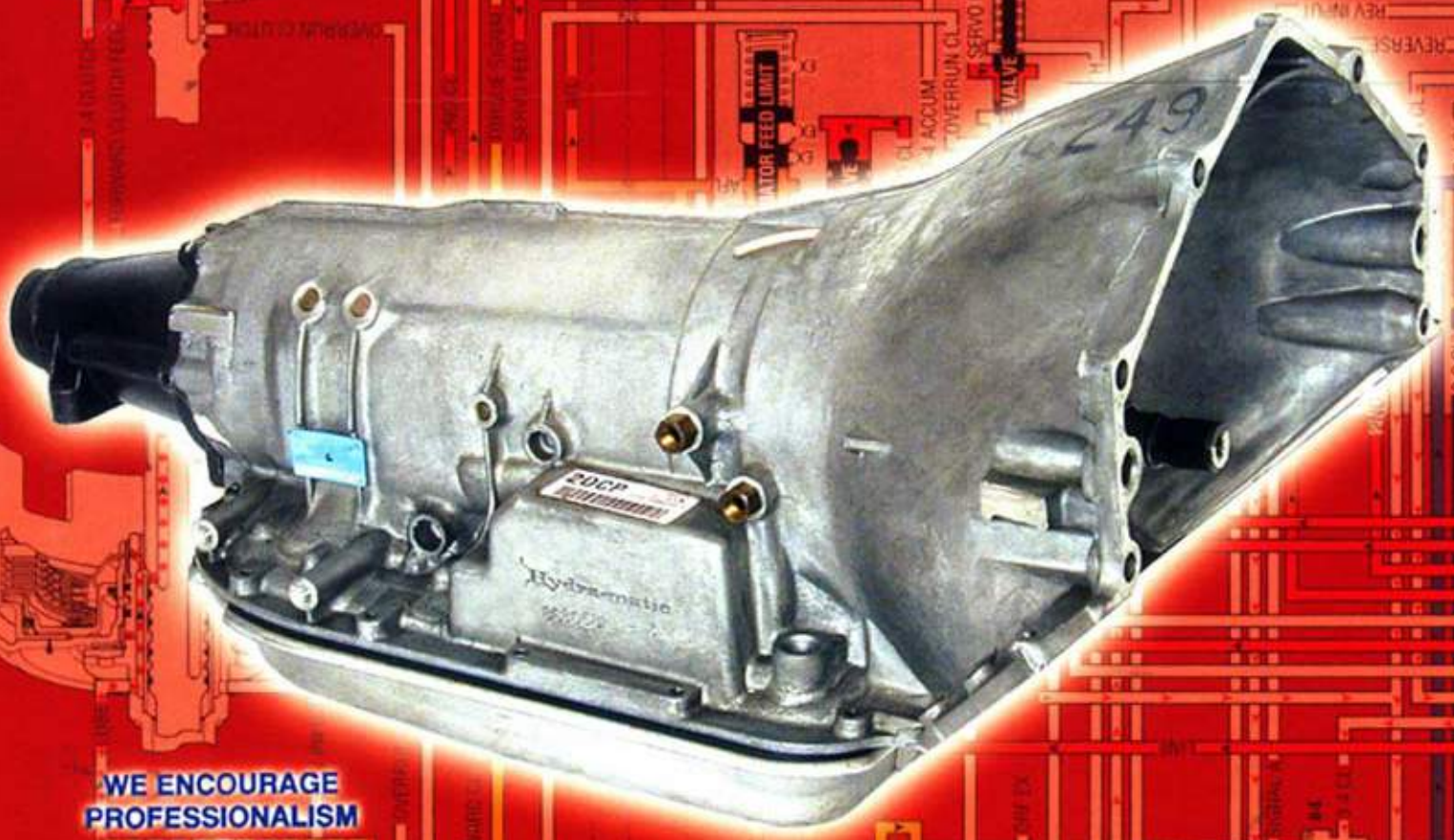
GM 4L80E Rebuild Procedures

By Cliff McCormick



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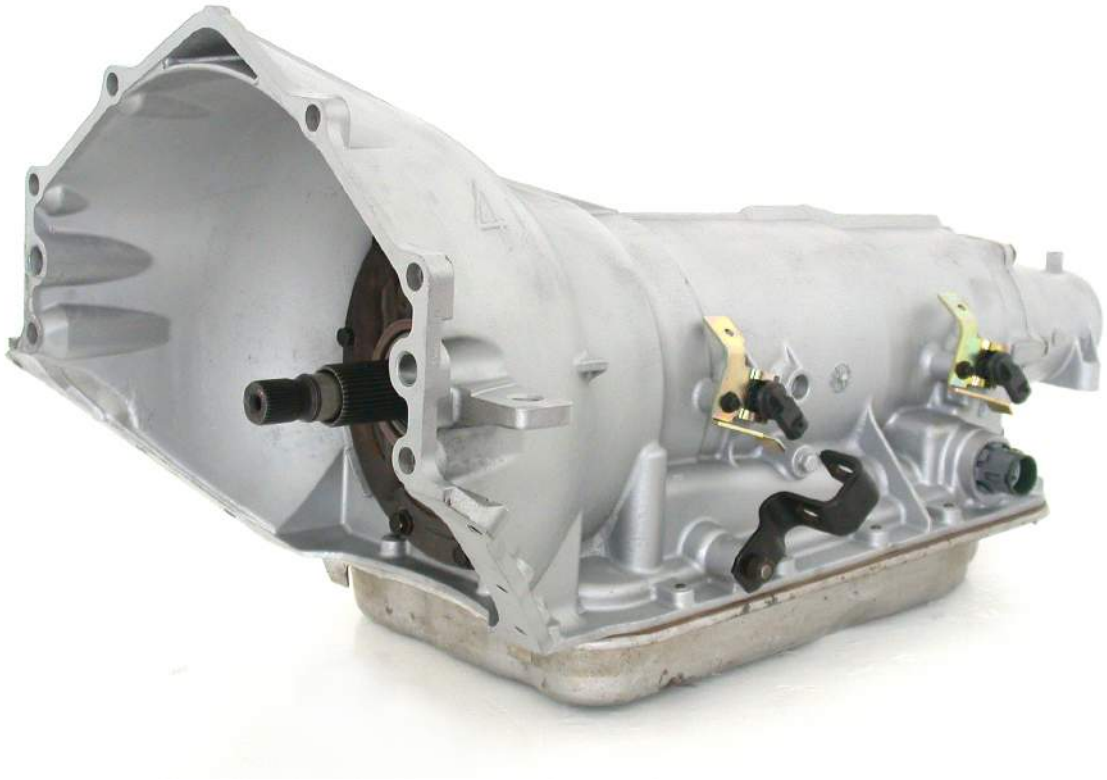
GM 4L80E

Rebuild Procedures



Written by Clifford McCormick

Program Introduction…

The General Motors 4L80E, in production since 1991, has become the workhorse of GM's light truck series. This unit has also surfaced in some rather exotic and unexpected vehicles simply because those manufacturers wanted one of the best, most reliable units available at the time. Based on the bulletproof THM 400, which could take just about anything a car or truck could dish out without breaking a sweat, the 4L80E was the natural evolution of the 400, updating the design with a beefy overdrive section built into the case in front of the venerable tried-and-true three speed. No longer does the old governor/modulator debate tell the transmission what to do, when and how much to do it. Fully computerized control of the shift points, torque converter clutch engagement and line pressure control ensure that the 4L80E will be with us for quite some time to come, easily interfacing with the newest powertrain control and diagnostic computer systems.

There may be parts of the rebuild process that you are not very familiar with, or you may be new to this particular type of transmission. In either case, you need some point of reference- something that will show you how to proceed when you are not sure (or have no idea whatsoever), and that is exactly what this book is designed to do.

You will not find a photocopied section out of a factory manual between these covers. In fact, you will notice a substantial difference between the book you are holding and any other books written on the subject. This is because, as this book was being written, the author was rebuilding a 4L80E step by step as he was writing this book. This helps assure that there would be no missing steps (and it was also quite handy for taking pictures along the way…). This book was written for transmission rebuilders by a transmission rebuilder, in plain English rather than complex 'factoreze' terminology, or instructions that have been partially 'transrated' from some other language.

So, whether you've already done a few of the 4L80E units or are about to tackle your first one, this book will show you how to get through the sticky parts of a rebuild, as well as the most thorough way to get through the job, start to finish. Thank you for your attention, your efforts and your trust.

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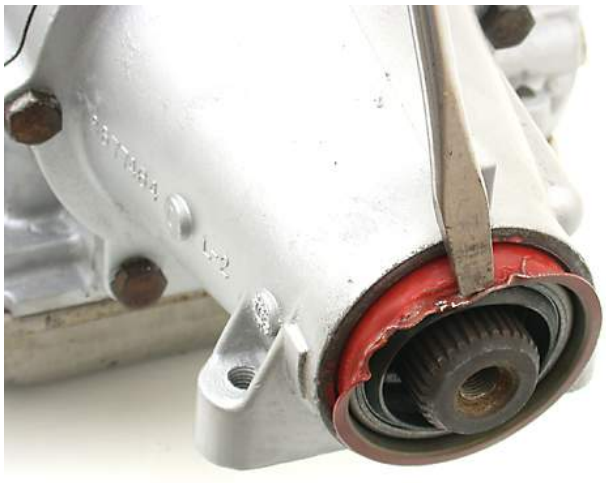
1 4L80E Rebuild Procedures

Unit Disassembly

Step 1: Unbolt the shift lever and speed sensors, remove them from the case, then use a pick to remove the o-rings from the sensors.

Note: The next two steps only apply to 2-wheel drive units.

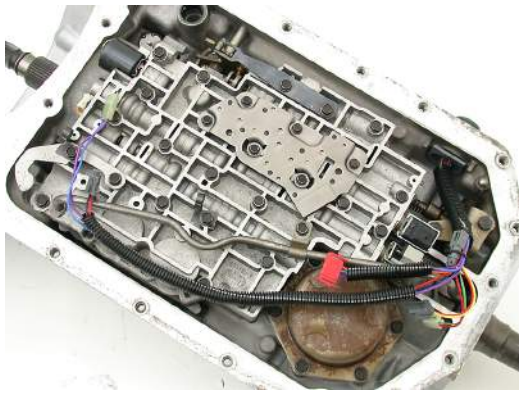
Step 2: The rear seal usually needs to get repeatedly bashed with a hammer and screwdriver or chisel to remove it from the extension housing as shown. This will definitely be easier to do while the housing is still bolted to a big, heavy transmission, rather than chasing the extension housing with your tools all over your bench and the shop floor after it's been removed from the unit. Save yourself the embarrassment of somebody else seeing this clown act by removing the seal now in a dignified manner.



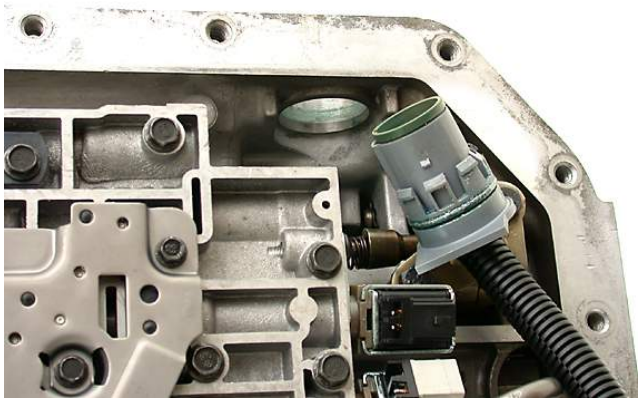
Step 3: Remove the extension housing bolts, and slide the extension housing off of the case. Remove the o-ring from the shaft groove, paying careful attention to any thrust washers, bearings or seals on the shaft; the exact configuration depends on the unit you're working on.

Step 4: Unbolt the transmission oil pan, and remove the pan, gasket and oil filter from the unit. Be careful with the pan gasket if it’s rubber and has metal bolt holes— it's reusable as long as it’s still soft and isn’t nicked or cut anywhere. Discard the filter.

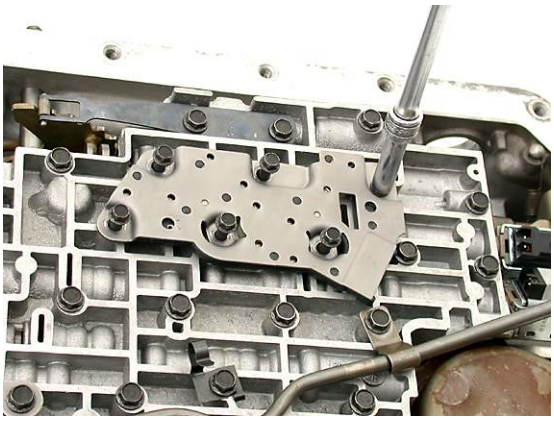
Step 5: Carefully disconnect the transmission wiring harness connectors from the solenoids and switches on the valve body.

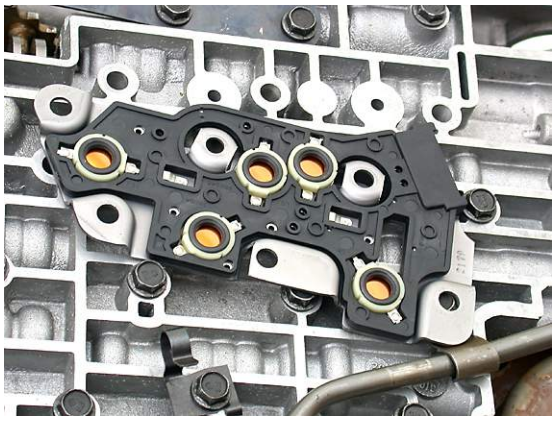


Step 6: Push a 1-1/4", 12-point socket or box wrench over the transmission case connector to compress the retaining clips, and carefully push the case connector into the case to remove it. Don't pull on the wires; they can break internally, and cause electrical problems later.

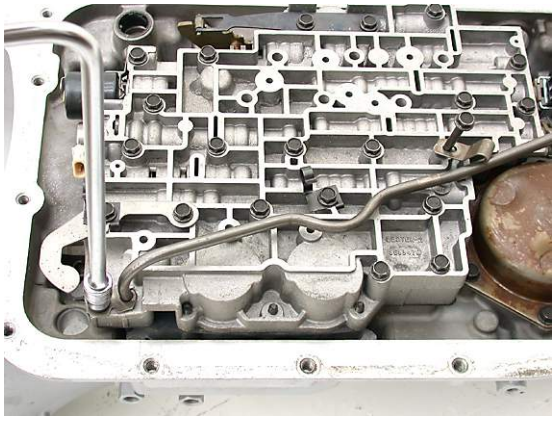


Step 7: Remove the Pressure Switch Manifold (PSM) bolts, and remove the switch.

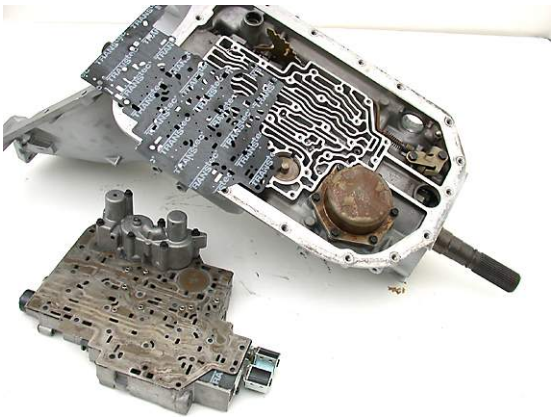




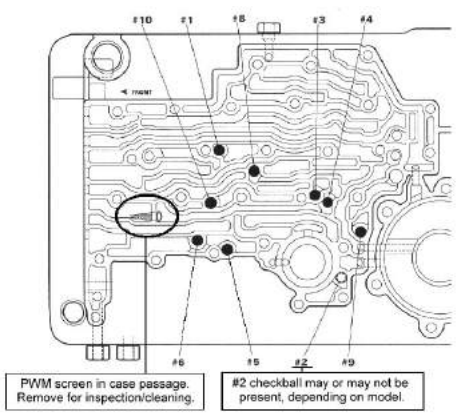
Step 8: Remove the bracket holding the lube oil pipe in place, and carefully remove the pipe from the unit.

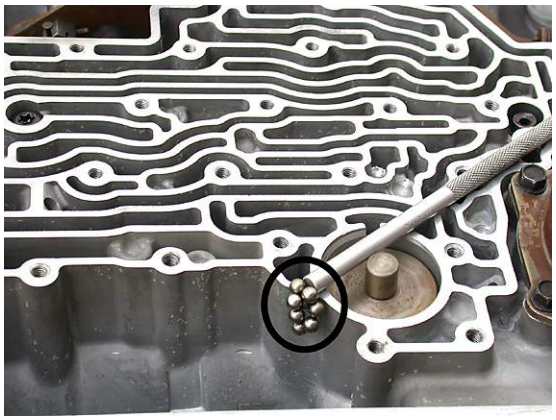


Step 9: Unbolt the valve body and accumulator assembly. Remove the valve body and accumulator assembly, separator plate and gaskets from the transmission.



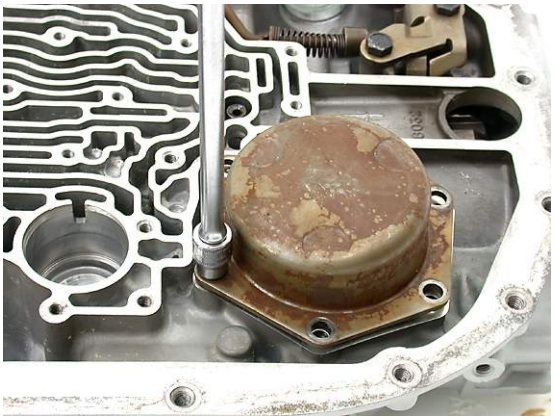
Step 10: Remove the case filter and checkballs from the case.



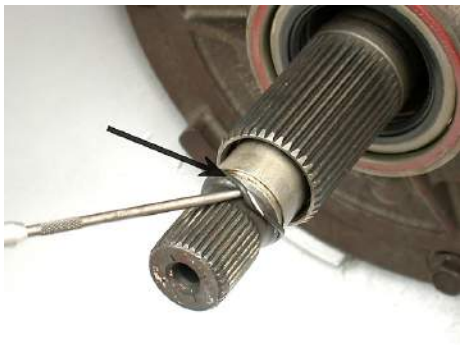


Step 11: Remove the Manual 2 brake band servo and spring, located directly in front of the low/reverse servo cover.

Step 12: Unbolt the low/reverse servo cover. Remove the cover, gasket, servo and return spring from the case. Discard the gasket.



Step 13: Remove the o-ring seal from the groove near the front end of the turbine shaft.

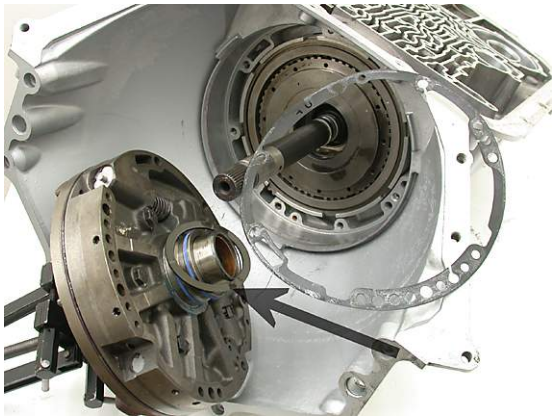


Step 14: While the pump is bolted to a nice heavy transmission, use a screwdriver or chisel and hammer to distort and pry out the front seal. Be careful not to gouge stuff nearby while doing so, particularly the stator splines.

Step 15: Unbolt the pump, and use an appropriate puller to remove the pump from the unit. If the pump doesn't slide out of the case easily with the puller you can *gently* tap the turbine shaft side to side with the plastic side of your hammer head.

CAUTION: Do not pry between the back side of the pump and the case passages. You may crack a passage without even knowing it, which pretty much guarantees a failed transmission rebuild.

Step 16: Make sure you don't lose the thrust washer that sits behind the pump. Discard the pump gasket if it comes off of the case and pump peacefully. If it doesn't, deal with it later after the parts washer softens it up some.



Step 17: Grab the turbine shaft, and lift the overdrive assembly out of the unit. Make sure you don't lose the thrust bearing between the overdrive unit and the forward clutch assembly.

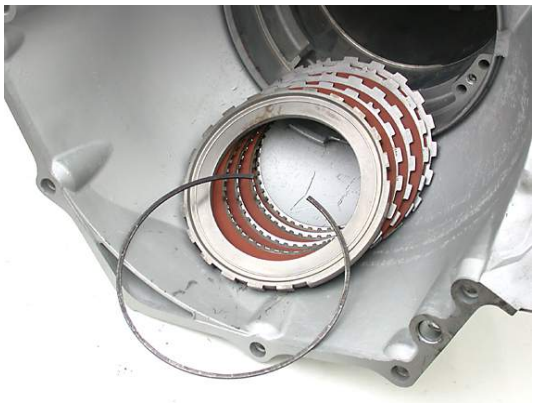
Step 18: Remove the 4th clutch bolt from the bottom of the case, and lift the 4th clutch out of the case. Due to the stress of the proper torque on the bolt, you should replace this bolt every time you remove it.

Step 19: Lift the forward clutch assembly out of the unit. Make sure you don't lose the thrust washer between the forward and direct clutch assemblies.

Step 20: Slide the direct clutch out of the case.

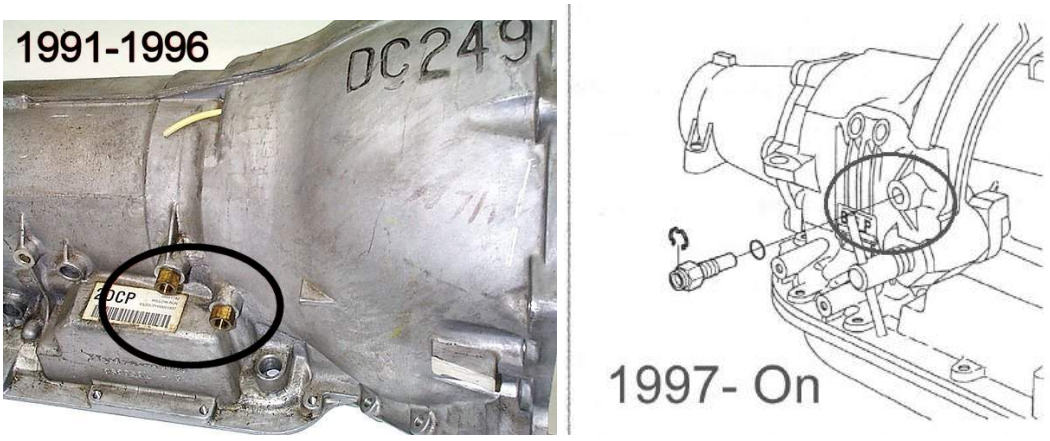
Step 21: Remove the Manual 2 brake band from the case.

Step 22: Remove the intermediate clutch snap ring, and lift the intermediate clutches out of the case.



Step 23: Remove the center support bolt; you should replace this bolt any time you remove it.

Step 24: Prior to 1997, cooler line fittings were positioned vertically near the front of the unit. Lube system modifications implemented in 1997 included repositioning the cooler lines, one in front, one to the rear. The new design rear cooler line fitting protrudes *into* the center support, and will be destroyed if not removed before any attempt is made to remove the center support. Remove the rear cooler line fitting at this time if equipped.



Step 25: Remove the center support snap ring.

Step 26: Slide the center support out of the case, either alone or with the gear train as one complete assembly. Either way, the rest of the gear train should slide out of the case. Make sure you don't lose either of the thrust washers that sit between the rear unit and the case.

Step 27: If the selective thrust washer is still at the bottom of the case, remove it. Remove the support snap ring, and the low/reverse band from the case.

Note: The next step only applies to 4-wheel drive units.

Step 28: Remove the output shaft seal retaining snap ring, then remove the output shaft seal from the case. If it won't easily pry out, remove the parking pawl bracket to gain access to the back of the seal for the hammer-and-screwdriver routine. Do not damage the seal's snap ring groove. Discard the seal.

Pump

Step 1: Remove the o-ring from the outside diameter of the pump.

Step 2: Remove the seal rings and thrust washer from the rear of the pump.

Step 3: Remove the pump assembly bolts, then separate the pump halves.

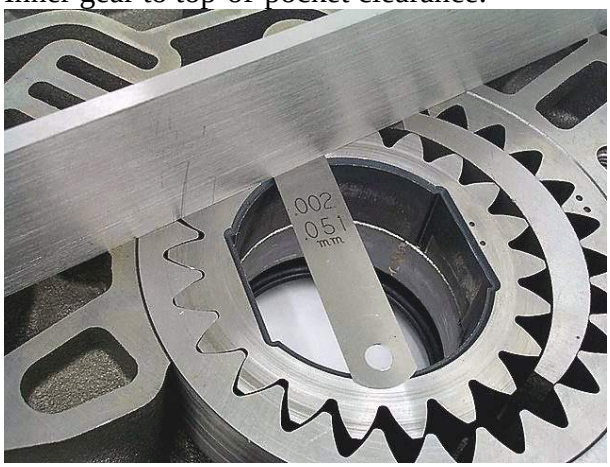
Step 4: Inspect the pump body and gear surfaces for wear including the inside of the inner pump gear where it contacts the torque converter hub.

Measure the following areas to be sure that the pump is in good shape.

Outer gear OD to gear pocket ID clearance:

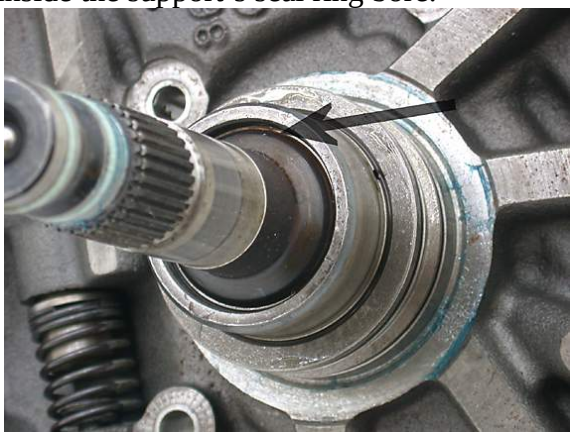
Outer gear to top-of-pocket clearance:

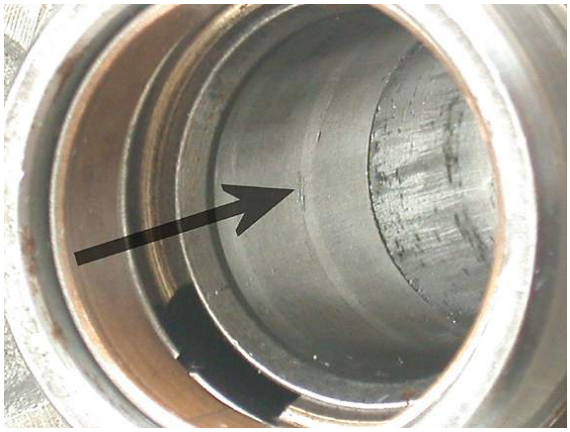
Inner gear to top-of-pocket clearance:



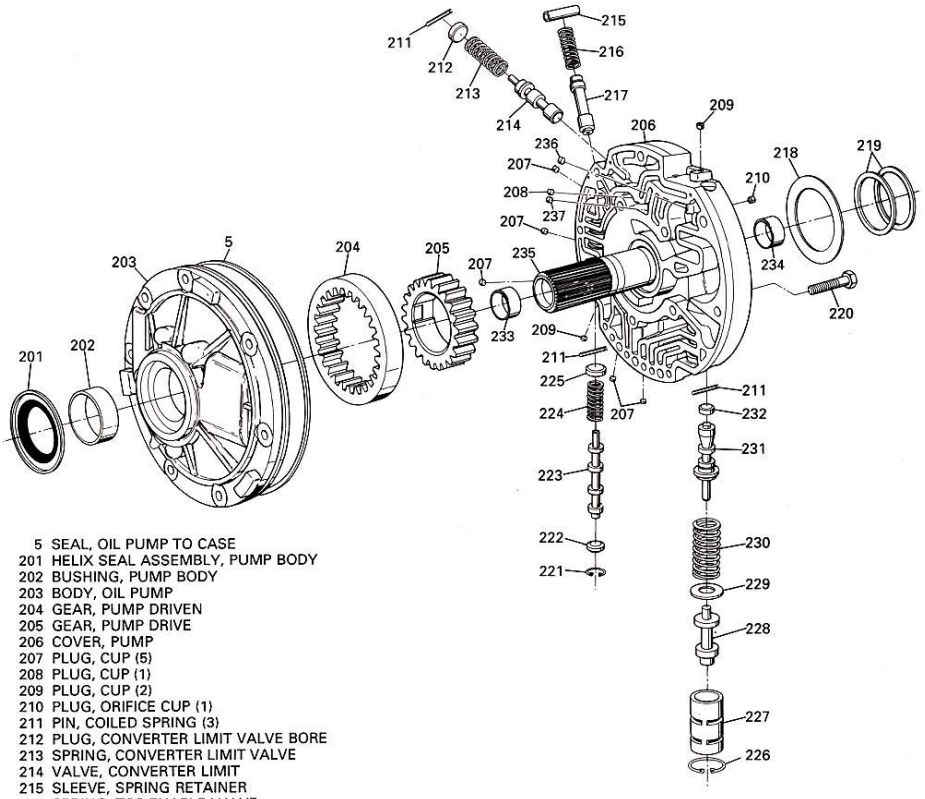
Step 5: Remove pump body bushing.

Step 6: Inspect stator support surfaces for wear from pump gears. If the stator support bushings appear to be in good shape and the turbine shaft bushing journals show no wear, you may decide to leave the stator support bushings alone. If they do need to be replaced, now is the time to remove the old ones. Also, make sure that there is no visible wear inside the support's seal ring bore.





Step 7: Remove all valve assemblies from the stator support, using this diagram as a guide. Carefully inspect the pressure regulator boost valve and sleeve for any wear and replace if necessary (the valve and sleeve are available without having to buy a whole pump).



5 SEAL, OIL PUMP TO CASE
201 HELIX SEAL ASSEMBLY, PUMP BODY
202 BUSHING, PUMP BODY
203 BODY, OIL PUMP
204 GEAR, PUMP DRIVEN
205 GEAR, PUMP DRIVE
206 COVER, PUMP
207 PLUG, CUP (5)
208 PLUG, CUP (1)
209 PLUG, CUP (2)
210 PLUG, ORIFICE CUP (1)
211 PIN, COILED SPRING (3)
212 PLUG, CONVERTER LIMIT VALVE BORE
213 SPRING, CONVERTER LIMIT VALVE
214 VALVE, CONVERTER LIMIT
215 SLEEVE, SPRING RETAINER
216 SPRING, TCC ENABLE VALVE
217 VALVE, TCC ENABLE
218 WASHER, THRUST SELECTIVE
219 RING, OIL SEAL (2)
220 BOLT, M8 X 1.25 X 40 (5)
221 RING, SNAP
222 PLUG, TCC VALVE BORE
223 VALVE, TCC
224 SPRING, TCC VALVE
225 PLUG, TCC VALVE BORE
226 RING, RETAINER (REV. BOOST VALVE BUSHING)
227 BUSHING, REVERSE BOOST VALVE
228 VALVE, REVERSE BOOST
229 RETAINER, PRESSURE REGULATOR SPRING
230 SPRING, PRESSURE REGULATOR
231 VALVE, PRESSURE REGULATOR
232 PLUG, PRESSURE REGULATOR
233 BUSHING, STATOR SHAFT (FRONT)
234 BUSHING, STATOR SHAFT (REAR)
235 SHAFT, STATOR
236 PLUG, CUP (1)
237 PLUG, CUP (1)

Step 8: Thoroughly clean all pump body and stator support parts. Make sure that you remove any sealer residue from the pump body front seal bore.

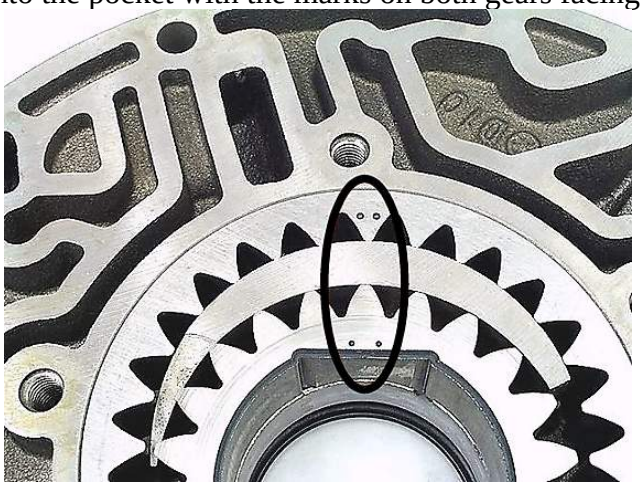
Note: ATRA Technical Bulletin #264 includes important information and modifications regarding every 4L80E you rebuild. This bulletin is included at the end of the pump section on page **20**. If you are not familiar with what it covers, take the time now to read and become familiar with it.

Step 9: Reassemble all valve trains into the stator support using the diagram in Step 7 as a guide. Install new stator support bushings if required.

Step 10: Coat a new front pump bushing with thread locking compound, then press the bushing into the pump body. To make sure the bushing is square with the bore, you can press it through until it's a little above flush with the pump pocket. Then use a bushing driver that's larger than the bushing bore to press the bushing down flush with the pump pocket. Stake the bushing into place in the bore stake slots as shown.

Step 11: Coat the outside diameter of a new front seal with a fast-drying, hardening sealer to lock it in place, and press the seal into the pump seal bore.

Step 12: Coat the pump pocket and front bushing with assembly lube. Install the pump gears into the pocket with the marks on both gears facing up toward you.

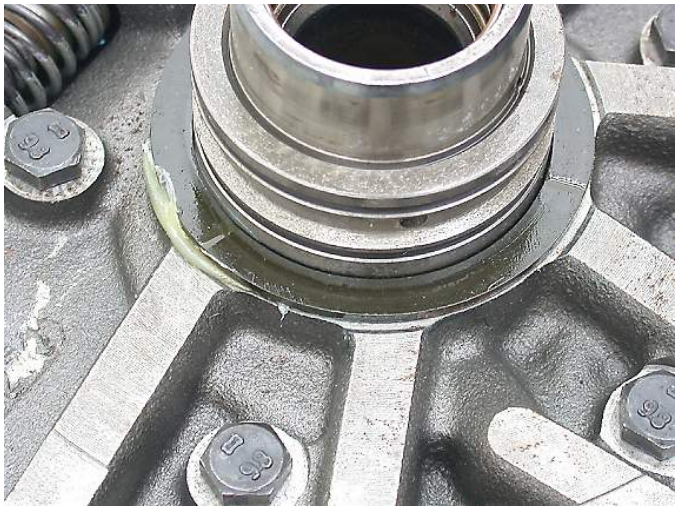


Step 13: Lower the stator support into position over the pump body, lining up the body feed passage ends with the support feed holes. Thread the pump assembly bolts into place, but leave them about a half-turn loose.

Step 14: Place a pump alignment strap or large hose clamp around the pump covering where the two halves meet. Rotate the support to center the outer bolt holes by eye while tightening the strap.

Step 15: Torque the pump assembly bolts to 18 ft/lbs. Remove the alignment strap or clamp.

Step 16: Use assembly lube to hold the thrust washer in place on the back of the stator support.



Step 17: Coat the grooves on the back of the stator support with assembly lube, then install the overrun clutch teflon seal rings into the grooves. There are special tools designed to do this, and we recommend you get and use them, particularly on a unit as common as this one. However, if you're very careful, you can work the rings into the grooves by heating them with hot tap water, then gradually stretching them into position with a pick, then using a hose clamp to compress them into the grooves. Leave the clamp in place until you're ready to install the pump into the transmission.

Step 18: Slide a torque converter hub into the pump or place the pump on a torque converter to make sure that the pump gears can rotate within the pump. It's normal to feel a little resistance from the grease on the gears as they rotate.

Step 19: Slip the pump body o-ring into the groove around the pump making sure that it's not twisted, give it a coat of assembly lube and this pump is ready to go.

BULLETIN Technical

1994

Technical Bulletin #264

- Transmission: 4L80-E
- Subject: High line pressure
- Application: GM Trucks, Isuzu, Jaguar

4L80-E

High Line Pressure
Broken Direct Clutch Drum
Broken Case

A broken direct clutch drum and/or case is usually the result of high line pressure (enough to 'peg' a 400 psi gauge). This is usually caused by reverse boost oil that is introduced into the torque signal circuit. If this pressure can not escape through the torque signal circuit (via the separator plate feed hole and force motor) the result is uncontrollable line rise. There are several measures you can take to prevent or reduce this effect.

NOTE: If pressure is high only in reverse, follow steps one through four (these can be done in the vehicle). If pressure is high in all ranges and/or the unit has failed (due to high pressure), remove the unit and follow steps one through five.

1 **Replace the reverse boost valve.** The most common cross-leak point is the reverse/torque signal boost valve. When the boost valve bushing wears out, reverse boost oil is allowed to enter the torque signal passage. If you have an existing high line pressure problem replace the boost valve and bushing. The valve and bushing are sold separately. The part number for the valve is 8680549. The part number for the bushing is 8682856 (figure one). If your boost valve does not look like the one shown in figure one, you have a first design pressure regulator/boost valve assembly. If so, purchase the entire assembly. The part number is 8682998. **NOTE:** The bushing will have to be purchased separately. Do not reuse the old bushing if the new PR assembly is used.

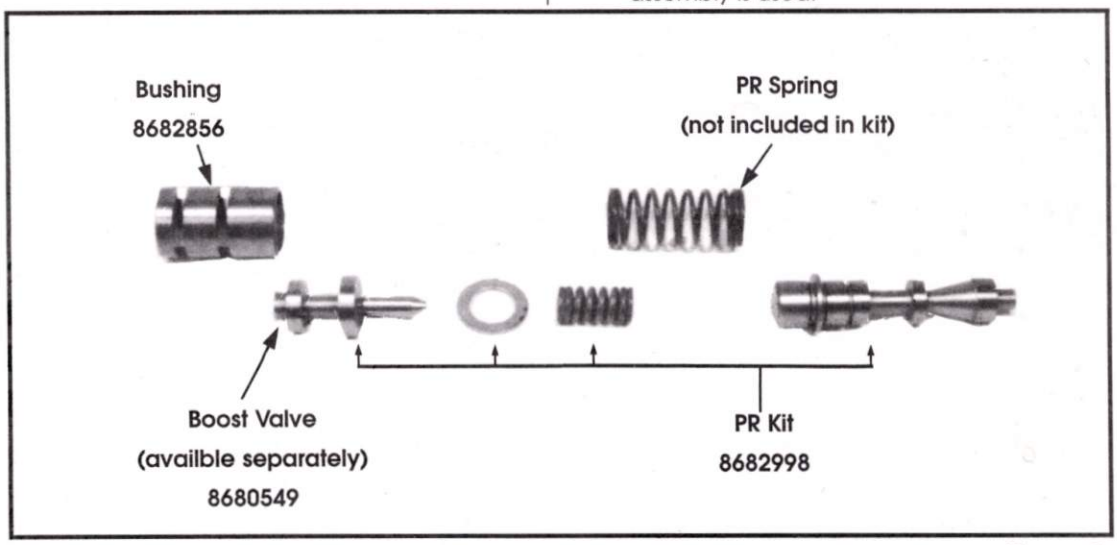


Figure 1

2 **Check the separator plate and valve body gaskets.**
There are currently two designs of separator plates and gaskets. This change occurred when a wall was added to the case (figure two). If you would like more information concerning these parts refer to ATRA bulletin number 209.

NOTE: A separator plate/gasket/case mismatch can cause high line pressure in reverse. However, once step three is performed, mismatches will not be a concern.

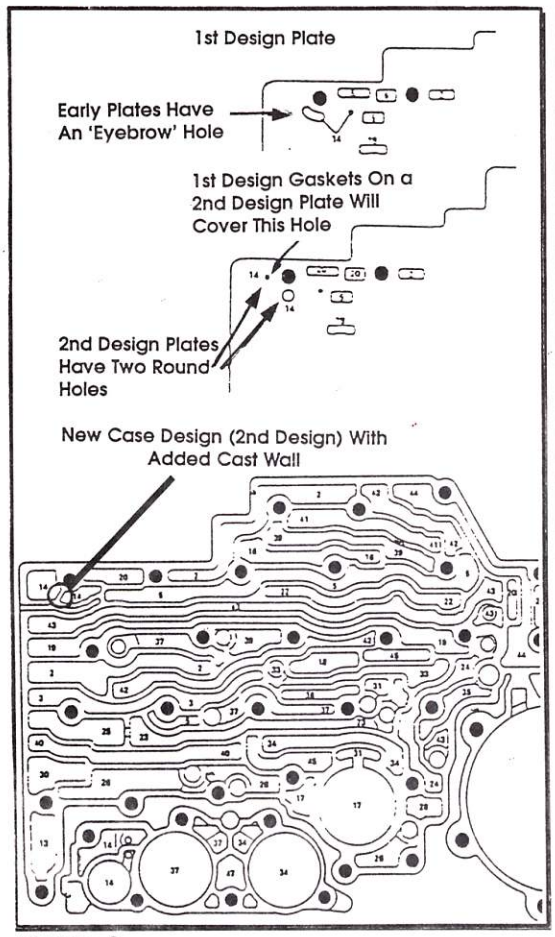


Figure 2

3 **Drill a 1/8"-3/16" hole through the case wall.**
This will offer a larger exhaust for reverse boost oil that has cross-leaked into the torque signal circuit (figure three).

NOTE: First design case does not have this wall.

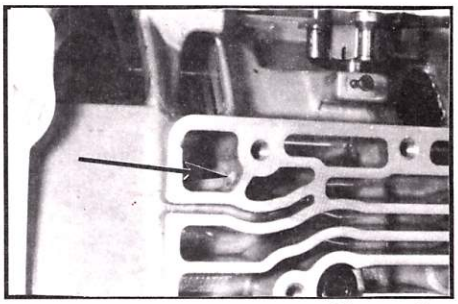


Figure 3

4 **Replace the force motor.**
Use the second design force motor (figure four). There are two advantages with the second design force motor.

1. It offers a larger exhaust for torque signal oil.

2. Balance oil must pass through a screen on the first design force motor. If the screen becomes clogged, the internal valve will not regulate. The second design force motor does not have this feature.

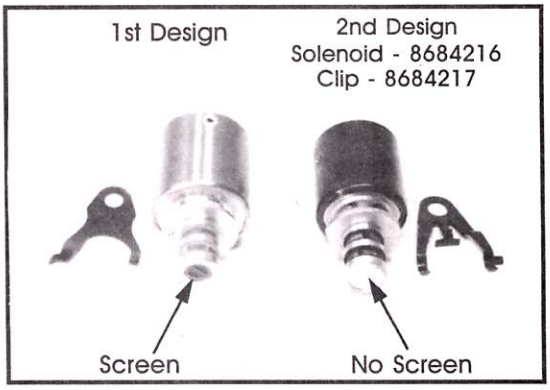


Figure 4

NOTE: The second design force motor will work on all models. The first design force motor should not be used on vehicles designed for the second design. For this reason, always use the second design.

5 **Modify/check the stator support.** Enlarge the pressure regulator balance feed to .070"-.075" line (figure five). This is a good measure to ensure that there is adequate back-pressure on the pressure regulator valve. Also check for a cracked PR plug (figure six).

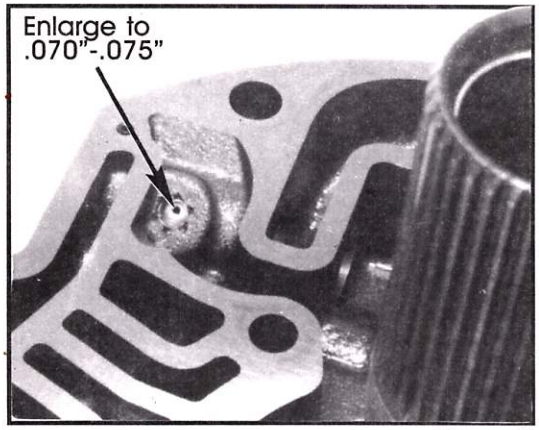


Figure 5

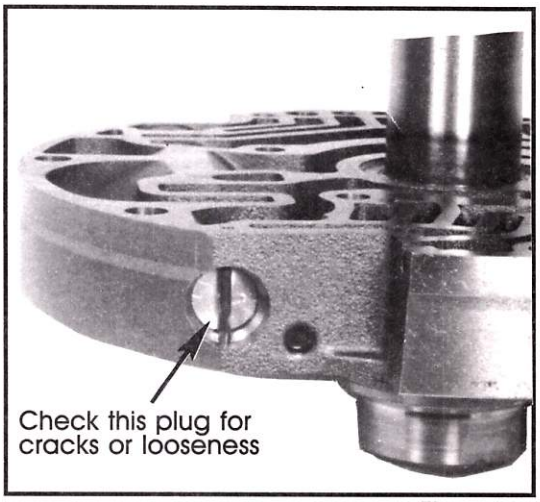


Figure 6

Make sure the air bleed (if equipped) has not been tampered with or is missing (figure seven). The orifice size is .020". If the orifice is missing or has been tampered with, plug the hole or replace the support.

NOTE: These modifications may offer a slight buzz during startup when cold. This will not affect the transmission's operation.

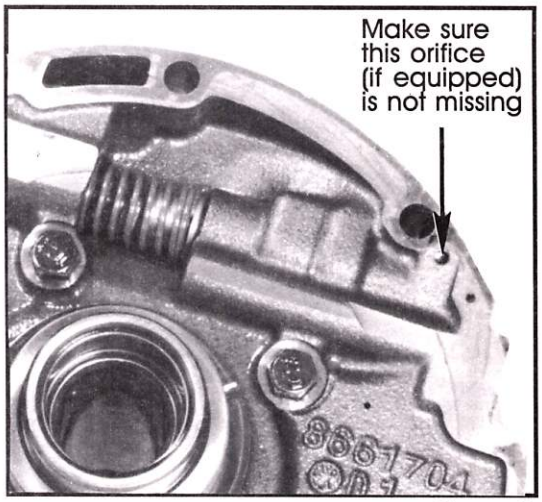


Figure 7

4th Clutch

Always soak friction clutches in clean ATF for at least 20 minutes before installing the clutches in the drum.

Note- It is almost impossible to properly perform these procedures without the proper 4th clutch lip seal installation tools. Have this tool set on the way before you begin work on your first/next 4L80E.

Step 1: If the clutch stack is still installed in the 4th clutch housing, remove the snap ring, and lift the clutch stack out of the drum.

Step 2: To remove the piston return spring assembly snap ring, place the 4th clutch housing upside down onto the base, or 'stand' portion of the lip seal installation tools. Press down on the return spring retainer near the snap ring end and, using snap ring pliers, pop one end of the snap ring out of its groove. Work your way around the housing as you press down on the return spring assembly, removing the snap ring from its groove as you go. Remove the return spring assembly.

Step 3: Remove the 4th clutch piston from the housing, and remove the lip seals from the piston and housing.

Step 4: Clean all components, and check for wear or damage:

- Check the piston for cracks or damage, particularly around the seal groove.
- Check the housing bore for wear or damage.
- Check the housing seal groove.
- Check the orifice cup plug in the housing.
- Make sure all fluid passages and openings are clear and clean.
- Check the snap rings for cracks or distortion.
- Check the return springs and retainer for cracks or distortion.

Step 5: Lubricate the new lip seals, and install them in the piston and 4th clutch housing. The housing seal lip should face the piston bore, and the piston seal lip should face down, toward the bottom of the piston.

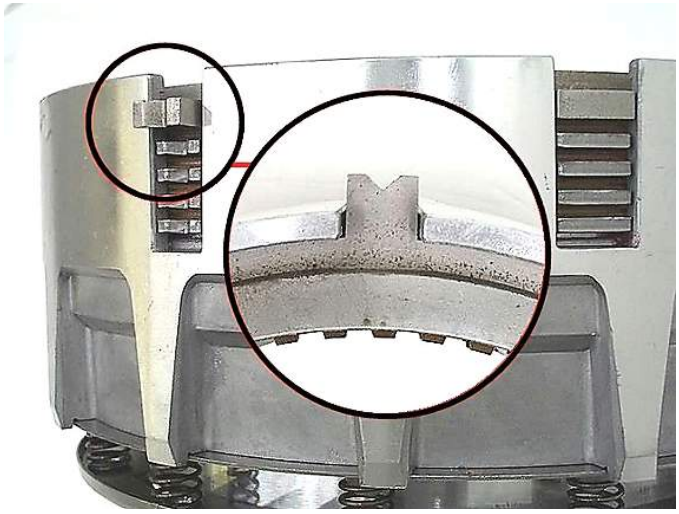
Step 6: Apply the proper lip seal installing tools, then gently guide the housing over the piston. Since both seals go into their respective bores at roughly the same time, this can drive you nuts if you don't use the proper lip seal installing tools. This is one of those times when you almost ***have*** to have the correct tools. Although it can be done with conventional lip seal tools and methods, if you use the usual wire or blade method of installing lip seals have lots of spare seals available the first few times you try it.

Whichever method you use, be certain that the piston is all the way into the housing bore.

Step 7: Leaving the housing assembly upside down on the installation base, set the return spring onto the apply piston. Use your thumb to compress one side of the return spring and start one of the snap ring ends in the ring groove, installing the snap ring into its groove as you go around the housing.

Step 8: Install the clutch stack in the housing, starting with a steel plate, then alternating friction, steel, etc. Make sure the notched steel lug of the steel plates sits in the one narrower groove in the housing, opposite the retaining bolt hole.

Step 9: Install the pressure plate, with the notch facing the same direction as the steel plates. Install the snap ring to secure the clutch stack.

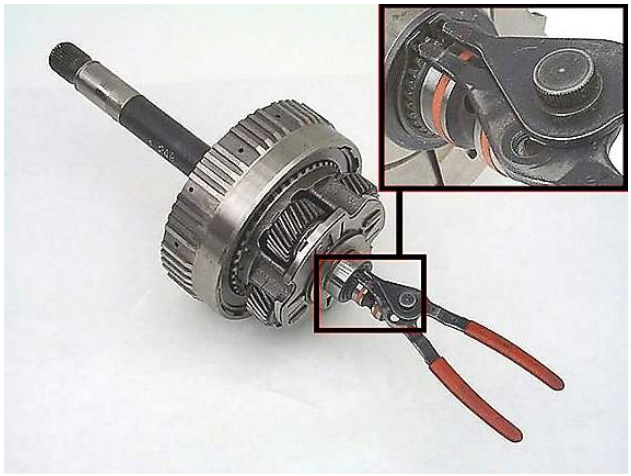


Step 10: Use a feeler gauge to check the clearance between the snap ring and the pressure plate. The clearance should be 0.040" – 0.100" (1.015 – 2.540 mm). If the clearance is wrong, change the pressure plate to bring the clearance into specs.

Step 11: Remove the clutch stack from the housing. This will make it easier to install the overrun clutch housing. Restack the 4th clutch during transmission assembly.

Overrun Clutch

Step 1: Remove the snap ring from the turbine shaft, and slide the turbine shaft out of the overdrive planet. Remove the oil control rings from the turbine shaft.

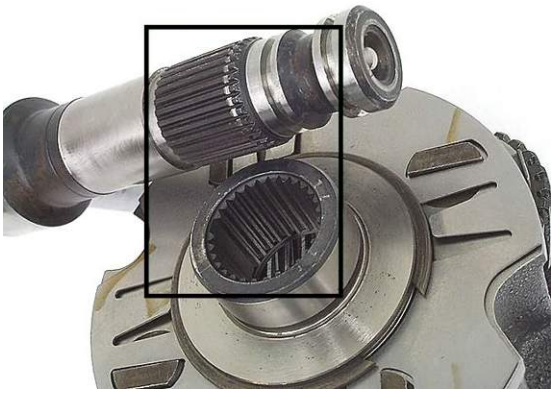


Step 2: Slide the overdrive planet out of the overrun clutches.

Step 3: Remove the overdrive roller clutch from the overrun clutch drum.

Step 4: Clean all overdrive planet components, and check for wear or damage.

- Check the planet pinions; make sure they rotate smoothly, don't rock, and that endplay is between 0.009" – 0.024" (0.230 – 0.610 mm).
- Check the gears for wear or damage; if you find any wear or damage, always replace the mating components, too.
- Check the internal and external splines on the planet and turbine shaft.
- Check all bushing and thrust surfaces on the planet and turbine shaft.
- Check the turbine shaft for cracks or damage, particularly around the seal ring lands and oil psassages.



Step 5: Check the one-way clutch element and outer race for wear or damage. Sand the roller clutch outer race in the drum with #320 grit emery cloth. Replace any worn components. In addition, replace the roller clutch for any of these reasons:

- Give the roller clutch a gentle shake: If any of the rollers fall out, the springs are worn — replace the roller clutch.
- If the original complaint could indicate a roller clutch problem, replace the roller clutch.
- If the roller clutch has been in service for more than 40,000 miles, replace the roller clutch.

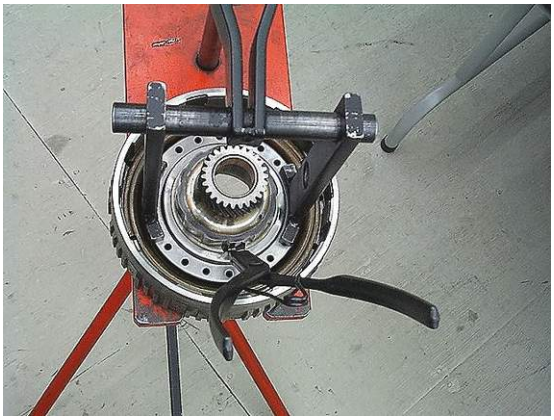
Step 6: Dip the planet and one-way clutch in clean ATF.

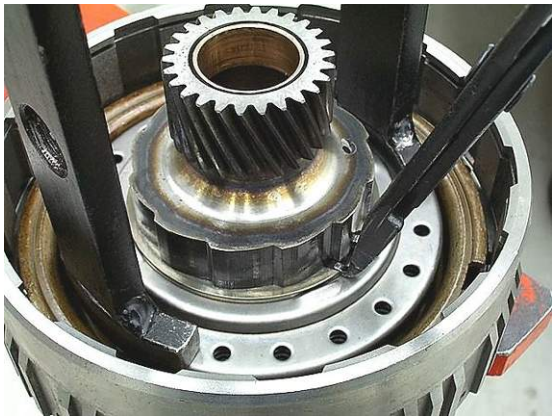
Step 7: IMPORTANT Only install the overrun clutch oil control rings as shown at this time. Don't install the forward clutch rings (the rings nearest the snap ring groove) yet — wait until after installing the turbine shaft into the planet assembly to install those rings. Soak the oil control rings in hot tap water to soften them for installation. Coat the oil control rings with assembly lube, then use the appropriate installers and sizers to install them on the turbine shaft.

Let the sizers remain in place for at least a minute, to give the oil control rings time to shrink back to the proper size.

Step 8: Remove the overrun clutch snap ring, and lift the overrun clutch stack out of the drum.

Step 9: Use a spring compressor to compress the clutch return spring, and remove the snap ring. Release the spring compressor.





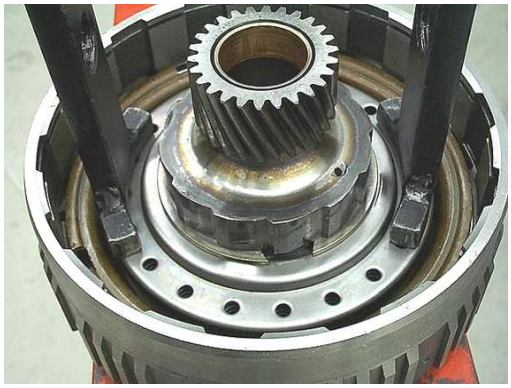
Step 10: Remove the return spring assembly from the overrun clutch drum. Remove the overrun piston from the drum.

Step 11: Clean and check all of the overrun clutch components:

- Check the steel plates for wear, heat checking or heat spots.
- Check the piston for cracks or damage. Make sure the rubber seal is soft, with no signs of wear or damage.
- Check the housing bore for wear or damage.
- Check the internal and external splines.
- Check the oil control ring contact surface.
- Check for wear on the inner one-way clutch ramps.
- Make sure all fluid passages and openings are clear and clean.
- Check the snap rings for cracks or distortion.
- Check the return springs and retainer for cracks or distortion.

Step 12: Lubricate the piston, and gently work it down into the drum. Keep the piston level, and rotate it into place.

Step 13: Lay the return spring onto the piston, then use the spring compressor to compress the return spring, and install the snap ring. Remove the drum from the compressor.



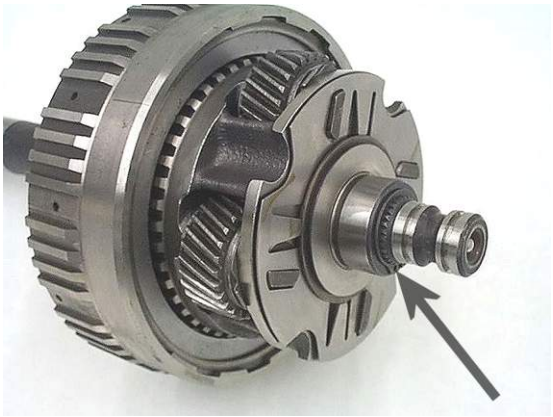
Step 14: Stack the clutches in the drum. Start with a steel plate, then alternate friction, steel, etc., followed by the pressure plate and snap ring. The stack should contain three frictions and three steel plates.

Step 16: Use a feeler gauge to check the clearance between the overrun pressure plate and snap ring. The clearance should be between 0.035" – 0.095" (0.840 – 2.380 mm). If the clearance is wrong, replace the pressure plate to bring the clearance into specs.

Step 17: Engage the roller clutch assembly with the ramps of the drum inner roller clutch race and lower it into position.

Step 18: Carefully work the overdrive planet into the overrun clutches. Make sure you work the one-way roller clutch down into the ramps.

Step 19: Slide the turbine shaft through the drum and planet assembly. Install the snap ring to hold the turbine shaft in the overdrive planet.



Step 20: Use the installer and sizer to install the oil control rings on the end of the turbine shaft. Prior to using the sizer to shrink the ring to the proper size, it is best to compress the ring as small as possible by hand to avoid pinching a 'loop' of ring between the edge of the ring land on the shaft and the sizer. Slide the sizer over the rings, and let it sit for at least a minute, to give the rings time to shrink back to size.

Forward Clutch

Step 1: Remove the clutch snap ring, and remove the direct clutch hub.

Step 2: Slide the forward clutch hub out of the clutches. Make sure you don't lose the thrust washers on either side of the hub.

Step 3: Remove the clutch stack from the drum.

Step 4: Use a clutch spring compressor to compress the forward clutch return spring, and remove the snap ring. Then release the compressor, and remove the return spring.

Step 5: Remove the clutch piston from the drum, then remove the lip seals from the piston and drum.

Step 6: Clean all components, and check for wear or damage:

- Check the steels for cracks, wear, heat checking or spotting.
- Make sure the cushion or wave plate is not cracked, deformed or flattened.
- Check the splines inside the drum.
- Check the lugs on the outside of the drum.
- Check the ring gear portion of the front of the drum for gear or thrust bearing pocket damage.
- Check the checkball in the drum; make sure it moves freely and seals properly
- Check the clutch splines on the direct clutch and forward clutch hubs
- Check the oil control ring bore
- Check the apply piston for cracks or damage, particularly to the seal grooves.
- Check the return spring and retainer for damage.

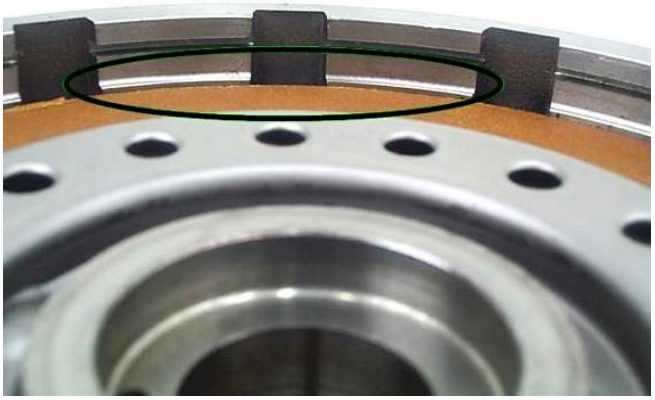
Step 7**:** Install the forward clutch center lip seal in the drum with the lip facing up, away from the bottom of the drum. Install the inner and outer lip seals into the piston grooves with the lips facing down, into the drum. Lubricate the seals and the bores in the piston and drum that the seals work against. To install the piston and return spring assembly into the drum, reverse the disassembly process shown above.

Step 8: Stack the new clutch and steel plates into the drum beginning with the clutch cushion plate. While usually a dished cushion plate, a waved cushion plate may be found here instead. If the cushion is a dished plate, always make sure it faces concave side up. In other words, the inside edge goes down toward the piston and the outside edge goes up against the bottom steel.

Step 9: Install the clutch plates, starting with the bottom steel, then friction, and so on. Finish with a friction plate.

Step 10: Check clutch clearance. Don't install either the forward or direct clutch hubs yet — they'll interfere with the clearance measurement. Although most service manuals instruct you to install the direct clutch hub and snap ring to measure forward clutch clearance, this method can be awkward, or even impossible, unless you have a particular type of extra-long, bent feeler gauges. Here's an easier method, borrowed from proven Turbo 400 experience:

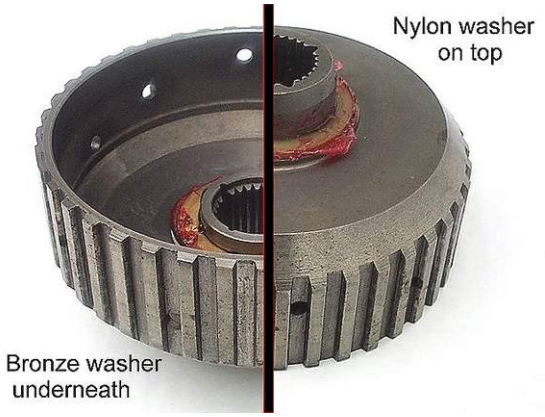
Make certain that the top surface of the last friction installed in the drum is below the direct clutch hub seating ledge in the drum.



Lay different feeler blades on top of the last forward friction plate. Find which feeler blade or combination of blades ends up flush with the hub seating ledge. Add .010" to the blade thickness to account for hub-to-snap ring clearance, and you have the forward clutch clearance.

The clearance specification is between 0.020" – 0.060" (0.500 – 1.500 mm), but keep in mind- this is a WORK transmission, typically used in heavy duty applications. It may spend long periods of time in park or neutral, possibly at high idle speed operating some type of auxiliary equipment on the truck. Build this clutch to the loose side of the specification to ensure *complete release* when the clutch is not supposed to be applied. Consider .035" - .040" the minimum allowed clearance. With this in mind, you'll want to see a combined feeler blade thickness of between .025" - .050". Use selective (thick/thin) steel plates to adjust as necessary.

Step 11: Install the thrust washers on either side of the forward clutch hub. The bronze washer goes between the drum and the hub (underneath the hub), and the nylon washer goes on top of the hub. Use assembly lube to hold the thrust washers in place.



Note: It's not unusual to find a 4L80E that has already been worked on, which has bronze thrust washers on *both* sides of the hub. This is okay, and you can put it back together that way.

Step 12: Slide the forward clutch hub into the clutch drum. Make sure you work the hub through all of the friction plates. If the hub rotates somewhat freely while being pressed down into the drum, all clutches are engaged.

Step 13: Install the pressure plate/direct clutch hub, then install the retaining snap ring, but only install the ring about halfway around the drum to hold everything in place. You'll be removing the snap ring and pressure plate later to assist main unit assembly.

High-Reverse (Direct) Clutch Assembly

The outside of this drum is used for a band dynamic apply surface. If it's too shiny-smooth or heat discolored, repair or resurface this drum surface using sandpaper grit no courser than #320.

Interchange Warning- Although the THM400 direct drum looks and acts almost identical to the drum used in the 4L80E, there are some critical differences between the two drums. The 4L80E direct drum uses a sprag type one way clutch for second gear, which can lock against and hold greater torque than the THM400 drum with the roller-type one way clutch.

This difference alone makes it an unwise decision to use the THM400 direct drum. On the other hand, some earlier, or heavy duty, or front wheel drive versions (THM425) of this drum had a rather beefy sprag rather than a roller clutch, and should be able to work well in a 4L80E. Just make absolutely certain that the direct clutch drum you're going to use has room for at least a five clutch plate pack.

Always soak friction clutches in clean ATF for at least 20 minutes before installing the clutches in the drum.

Step 1: Remove the direct clutch pressure plate snap ring, and remove the clutch stack from the drum.

Step 2: Use a spring compressor to compress the direct clutch return spring, and remove the snap ring. Then release the return spring, and remove it from the drum.

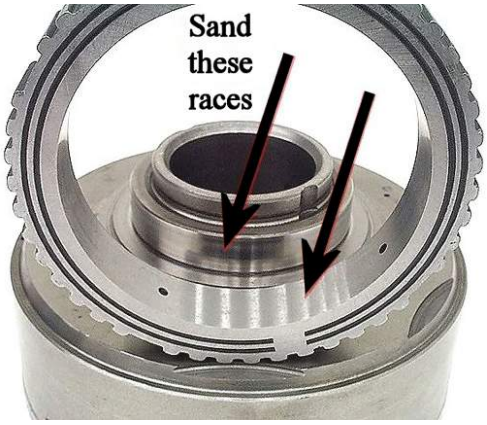
Step 3: Remove the direct clutch piston from the drum, then remove the lip seals from the piston and drum.

Step 4: Flip the drum over and remove the intermediate sprag snap ring. Slide the retainer plate, the sprag element, the outer race, and the sprag end plates off of the drum.

Step 5: Clean all components, and check for wear or damage:

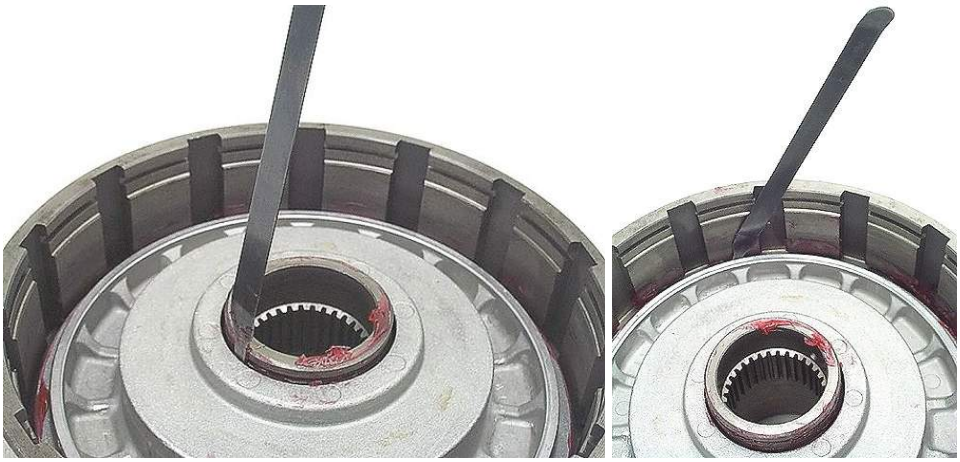
- Check the steels for cracks, wear, heat-checking or spotting.
- Make sure the cushion or wave plate is in good shape.
- Check the splines inside the drum for notches from the steel plates.
- Check the outer drum surface where the Manual 2 brake band rides.
- Check the checkball in the drum; make sure it moves freely and seals properly.
- Check the oil control ring bore.
- Check the apply piston for cracks or damage, particularly around the seal grooves.
- Check the return spring and its retainer for damage.
- Check the sprag element and replace it for any of these reasons:
    - The sprag teeth show signs of wear or damage.
    - The springs aren't holding the sprag teeth out.
    - The original complaint indicated a problem with the sprag or second gear.
    - The sprag has been in service for over 40,000 miles.

Step 6: Sand the inner and outer sprag races with #320 to #400 emery cloth.



Step 7: Install the direct clutch center lip seal in the drum with the lip facing up, away from the bottom of the drum. Install the inner and outer lip seals into the piston grooves with the seal lips facing down, into the drum. Lubricate the seals and the bores in the drum and piston that the seals work against.

By the way, I use a modified toolbox drawer tool (which is just a little strip of spring steel with bent ends) that I ground and buffed for nice thin, smooth edges on the ends. It works really well for easing the seal lip into a drum bore, particularly in tight places. Be really careful doing this though, because there's a good chance that you probably won't find out that you've sliced a lip seal until the vehicle is on the road test.



Step 8: Install the piston return spring assembly and snap ring using a suitable press or fixture, just like when you took them out.

Step 9: Install the cushion or wave plate. If the drum uses a dished cushion plate, always make sure the plate faces concave side up. In other words, the inside edge goes down toward the piston and the outside edge goes up against the bottom steel. Then install the rest of the plates, alternating steel, then friction and so on, ending up with five steel and five friction plates, followed by the pressure plate and snap ring.

Step 10: Check clutch clearance (I use bent-wire spark plug gauges to get down into the drum and between the plates). The clearance is 0.050" – 0.080" (1.270 – 2.030 mm). Build this clutch to the loose side of the specification to ensure proper *apply timing* between the direct clutch and the low-reverse band during reverse engagement. If this clutch is set up too tight, it may begin to apply *before* the rear band when going into reverse, which will cause a very harsh engagement. To avoid this, you may want to consider .060" - .070" a good *target* clearance to shoot for.

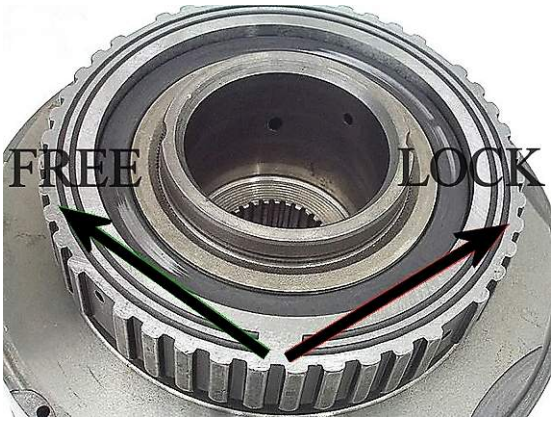
Step 11: To assemble the intermediate sprag:

- Turn the drum over, then place one sprag end plate over the drum inner race.

- Slide the intermediate sprag element onto the inner race, cage lip down on most brands of sprag element. Make sure that the sprag teeth are pointing in the same direction and angle, and shaped the same way as the above illustrations show.

- Place the other remaining sprag end plate on top of the sprag element.

- Install the sprag outer race, making sure that the side of the race with the grooves is facing *up*. Rotate the race clockwise while carefully working the race over the sprag element teeth. Once in position, the race should very easily turn clockwise, but should instantly lock if you try to turn it counterclockwise. If the outer sprag race turns counterclockwise without the drum turning, the sprag may be worn, damaged, defective, angry at you, or assembled upside down. Remove the outer sprag race and flip the sprag element over and try again.



Step 13: Once you have the intermediate sprag assembled and operating properly as described in the previous paragraph, place the wide retainer plate on top of the sprag, and install the snap ring to hold the assembly in place.

Center Support and Geartrain Assembly

Step 1: Slide the center support out of the reaction carrier. Make sure you don't lose the thrust washer on the back of the center support, or the sun gear front thrust bearing race that usually sticks to the support.

Step 2: Slide the sun gear shaft off the main shaft. Check the sun gear shaft for cracks, wear or damage. Check the bushings in the sun gear shaft.

Step 3: Remove the reaction carrier from the output carrier. Make sure you don't lose any part of the sun gear thrust bearing. The front race of this bearing may have come off with the center support.

Step 4: Slide the one-way clutch out of the reaction carrier and check the one-way clutch, its inner race and outer ramps for wear or damage. Replace any worn components. Replace the roller clutch for any of these reasons:

- Give the roller clutch a gentle shake: If any of the rollers fall out, the springs are worn — replace the roller clutch.
- If the original complaint could indicate a roller clutch problem, replace the roller clutch.
- If the roller clutch has been in service for more than 40,000 miles, replace the roller clutch.

Step 5: Remove the sun gear from the output carrier. Remove the thrust washer and the split black plastic silencer ring from the front of the output carrier.

Step 6: Flip the output carrier assembly, remove the case selective steel thrust washer, if it stuck to the output shaft during disassembly. Remove the babbit output shaft thrust washer and the output shaft snap ring.

Step 7: Remove the output shaft from the carrier assembly. Make sure you don't lose the thrust bearing from the ring gear.

Step 8: Slide the ring gear and mainshaft assembly from the carrier. Make sure you don't lose the thrust bearing and its races.

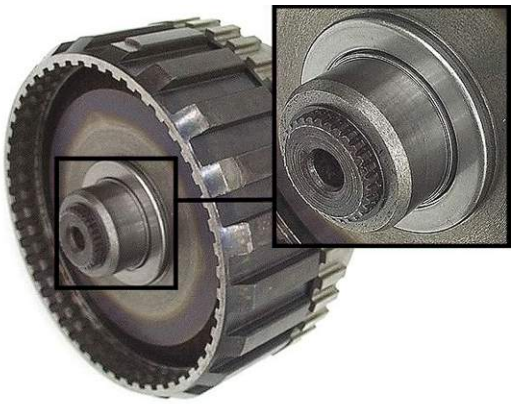
Step 9: Clean all geartrain components, and check them for wear or damage:

- Check all splines
- Check all snap ring grooves
- Check snap rings for cracks or distortion
- Check all gears for wear, cracks or damage. If you find any wear or damage, replace the mating components as well.
- Check the planet pinions: They shouldn't rock, and should rotate smoothly. Make sure each pinion's endplay is between 0.009" and 0.024" (0.230 – 0.610 mm)
- Check all bushings and bushings surfaces
- Check all thrust washers, thrust bearings and thrust surfaces
- Check the teeth on the output speed sensor exciter ring. Look for chipped, damaged or missing teeth. (Only on units with the output speed sensor in the transmission. Most 4WD units have the output speed sensor in the transfer case.)

Step 10: Slide the thrust bearing and races over the mainshaft, and into place on the inner ring gear thrust surface. Use assembly lube to hold the bearing and races in place.

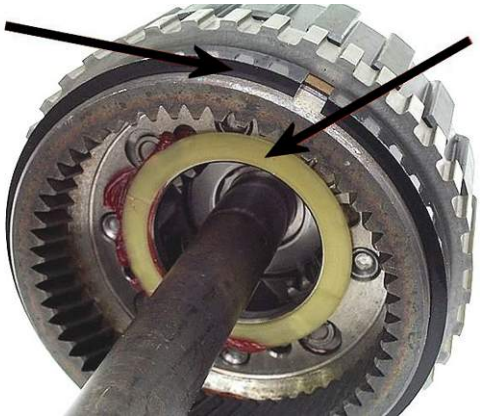
Step 11: Dip the output planet in clean ATF to lubricate the pinions. Slide the ring gear and mainshaft assembly into the planet.

Step 12: Install the ring gear thrust bearing and races onto the ring gear. Use assembly lube to hold them in place.



Step 13: Fit the output shaft into the output carrier, and install the snap ring. Place the output shaft babbit thrust washer onto the output shaft, holding it in place with assembly lube.

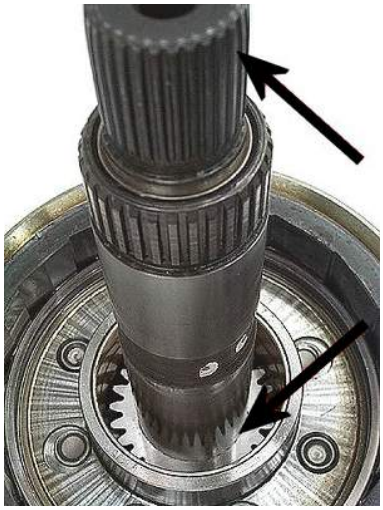
Step 14: Flip the assembly over, then slide the output carrier thrust washer into the carrier, and align the tabs with the notches in the carrier. Use assembly lube to hold the thrust washer in place. Slide the split black silencer ring onto the top of the carrier.



Step 15: Dip the reaction carrier in clean ATF to lubricate the pinions. Work the reaction carrier over the mainshaft, and into the output carrier.

Step 16: Work the sun gear into the reaction carrier, with the chamfered ID facing into the carrier.

Step 17: Assemble the sun gear shaft into the sun gear, with the long splines facing into the sun gear.



Note- It's always a good idea to double-check your assembly of the sun gear and sun gear shaft direction, since they can appear installed properly even when installed upside down, which will cause endplay conflicts or transmission failure in short order. Be sure that the sun gear end ID chamfer is aimed *down*, and the long sun gear shaft splines also aim *down*, into the sun gear.

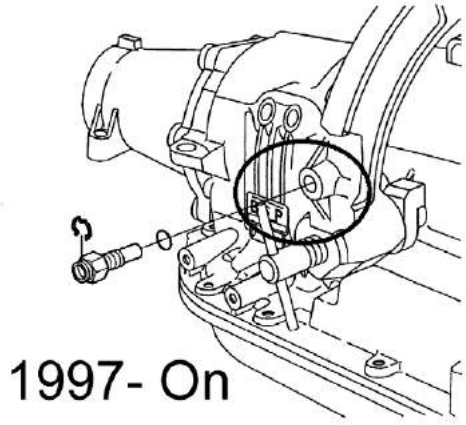
Step 18: Assemble the sun gear front thrust bearing and races onto the sun shaft as shown in this order:

- Race with the smaller ID and longer inner lip facing up
- Bearing
- Race with the larger ID and shorter inner lip facing up

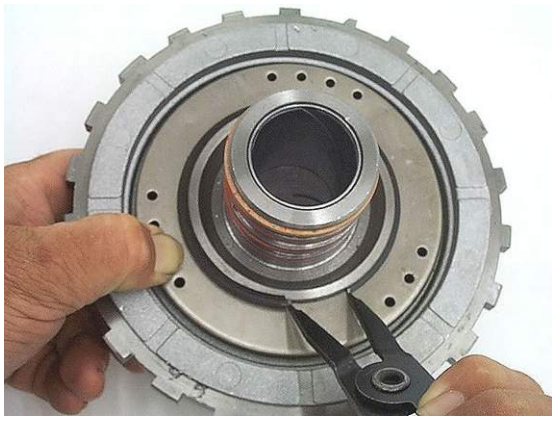
Use assembly lube to hold the bearing and races in place.

Step 19: Install the roller clutch into the top of the reaction carrier.

Step 20: On 1997 and later units, remove the oil cooler pipe fitting seal from the center support. ATB466 covers these changes in detail, showing the support and seal discussed here.

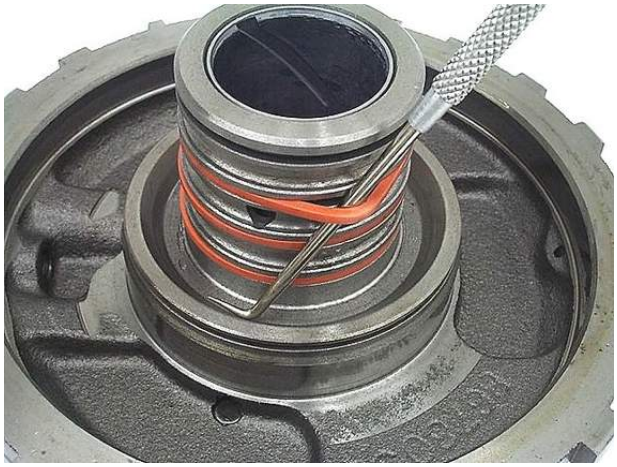


Step 21: To avoid damage to the intermediate clutch return spring retainer, use a thumb to compress one side of the retainer nearest one end of the retainer snap ring. Remove the snap ring and the return spring assembly.



Step 22: Remove the intermediate clutch piston from the center support, then remove the lip seals from the intermediate apply piston. Check the piston for cracks or damage.

Step 23: Remove the oil control rings from the center support hub. Be careful not to gouge the seal ring grooves in the support with your pick.



Step 24: Check the center support hub for wear or damage:

- Check the retaining bolt threads for wear or damage.
- Check the apply piston bore.
- Check the oil control ring lands for wear, cracks or damage.
- Check the bushings and bushing surfaces.
- Check the thrust washer and thrust bearing surfaces.
- Check the oil feed ports; make sure the orifice plug in the side of the support is open.

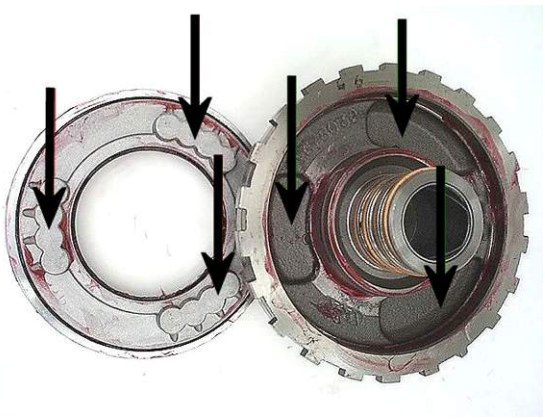
Step 25: On 1997 and later units, install the small oil cooler fitting-to-center support seal into the support, with the lip facing in.

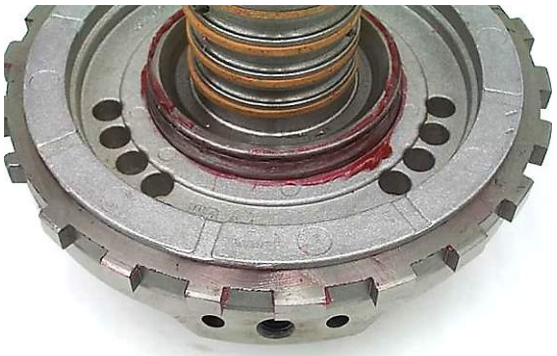
Step 26: Warm the rings in hot tap water to make the rings easier to install, and use liberal amounts of assembly lube in and around the ring grooves to protect the rings from installation damage. If you are going to cut corners on tool purchases, these rings can be installed with normal tools, such as a pick or scribe and a 3 inch hose clamp, but EXTREME care must be used to avoid even the slightest nick or cut on the new rings. The life of your clutch pack is determined by things like this, so you may want to reconsider the choice of buying the special seal ring tools versus quick easy shortcuts that can cause problems. If you're going to go the hose clamp route, make sure you install just one ring at a time starting with the top one, sizing each one down into the groove before moving on to the next one.

Step 27: Slide the ring sizer (or hose clamp) over the hub, and let it sit for at least a minute, to give the rings a chance to resize. Then remove the sizer, and coat the rings with assembly lube. Place the direct drum over the rings for a few minutes to help compress the rings to the proper diameter.

Step 28: Install the intermediate clutch lip seals on the piston with the lip facing down into the piston bore. Make sure you lubricate them.

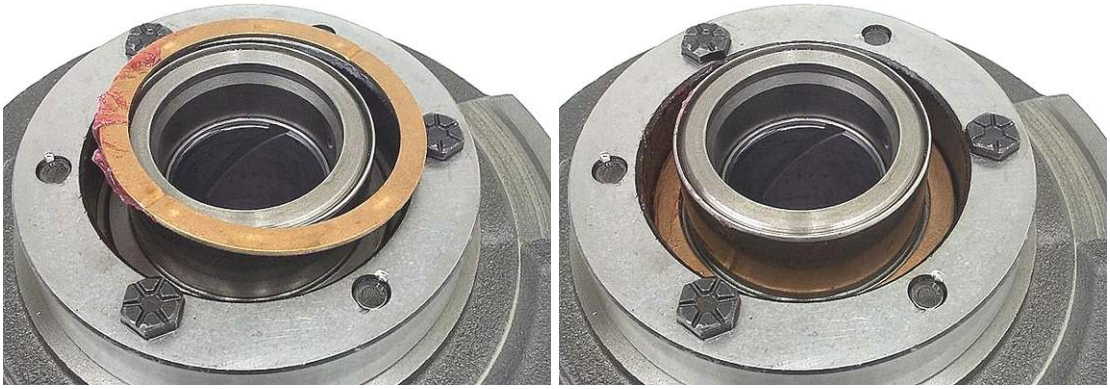
Step 29: Install the intermediate apply piston into the center support, being certain to line up the return spring pockets in the piston with the relief pockets in the support. One easy way to be sure the pockets are lined up- Notice that two of the three pockets in the support perfectly straddle the center support bolt hole. Be sure that two pockets on the piston also straddle the bolt hole in the support. Use a feeler gauge or piano wire to work the seals into their bores. Be careful not to cut or roll the seals.





Step 30: Lay the return spring assembly onto the piston, and compress the spring with your thumbs while installing the snap ring.

Step 31: Invert the center support, and place the thrust washer into the recess in the support. Use assembly lube to hold the thrust washer in place.

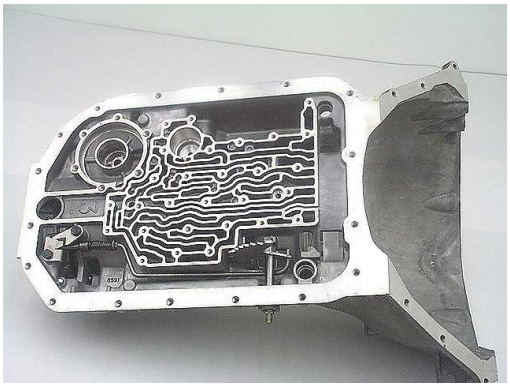


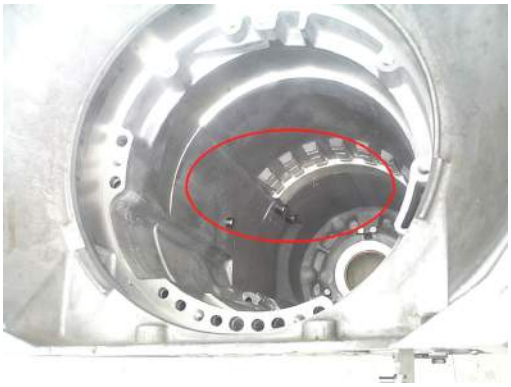
Step 32: Work the center support into the reaction carrier. Make sure the one-way clutch operates properly: Hold the carrier steady — the support should turn counterclockwise. This is a good time to clamp on your lifting/holding device to move this rather heavy assembly around.

Case Inspection and Service

The 4L80E is used in GM's biggest and most powerful light trucks, and it is not uncommon to find that the vehicle has been excessively loaded or abused, and the transmission has been overloaded or overheated. The transmission case is one of the more common victims of this type of abuse, showing impact damage, heat damage, load damage breaking or cracking critical case areas, and stress damage deforming the case and causing cross-leaks and premature or repeat failure. Be sure to carefully inspect the entire case all over for these types of damage.

Step 1: Inspect the case for cracks, wear or damage in these locations:

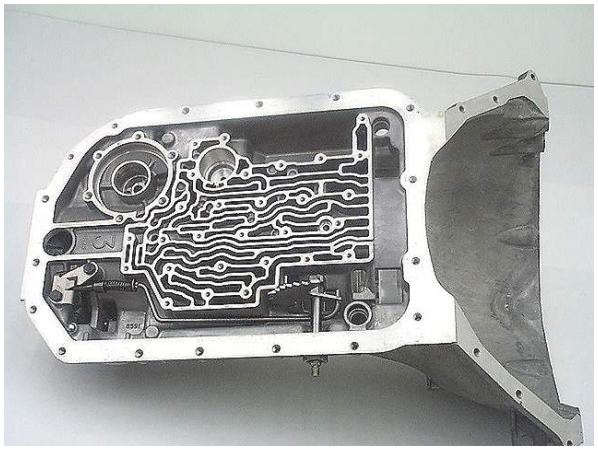




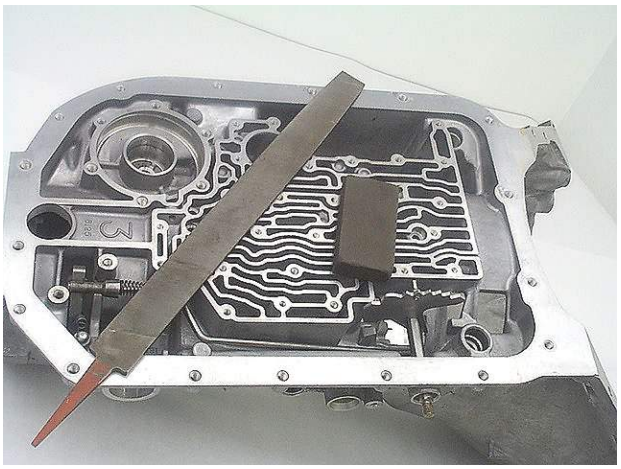
- All fluid passages
- Servo bores
- Bell housing cracks just in front of the pump
- Pump mating surface
- Internal case clutch mounting lugs
- Snap ring grooves
- Cooler connectors and threads
- Vent pipe and case mountings
- Bushing and thrust washer surfaces

Step 2: Using a piece of wire, check the case vent for restriction or pluggage.

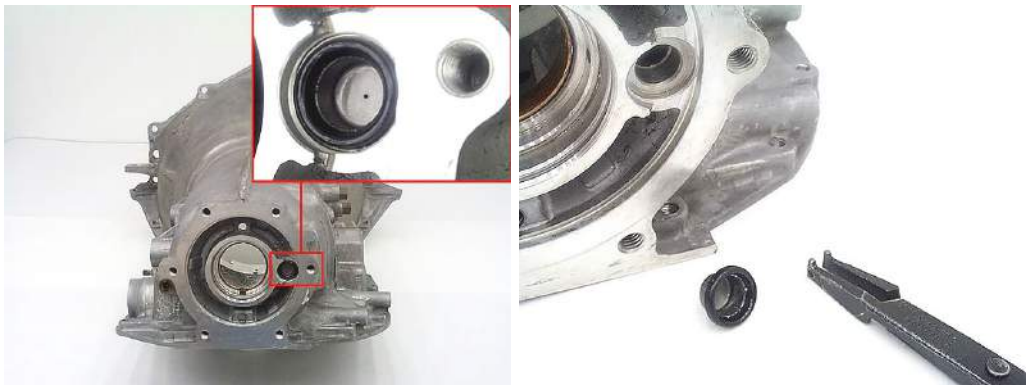
Step 3: Check and repair any pulled or damaged threads.



Step 4: Flat stone or carefully flat file the valve body mating surface.

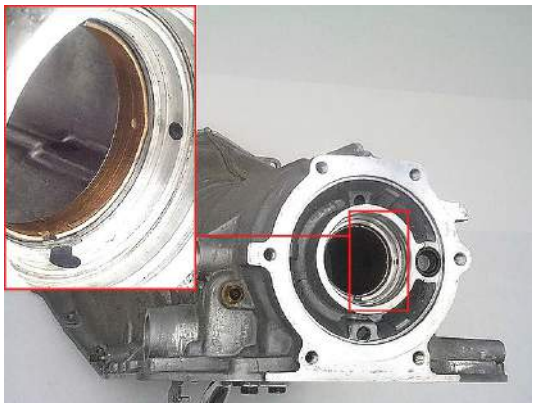


Step 5: On 2WD units that have had particles spread throughout the unit, remove the orifice cup plug in the back of the case that feeds lube oil to the extension housing bushing. A pair of standard transmission snap ring pliers can help with this, using a spreading and twisting motion.



Step 6: Clean the case thoroughly, and make sure all fluid ports and passages are clear.

Step 7: Check the bushing in the back of the case, and replace if necessary. Do not try to stake the bushing at the same locations the original bushing was staked. Use a thread locking compound instead.



Step 8: Use a Scotchbrite pad to scuff up the low/reverse and 2-1 servo bores.

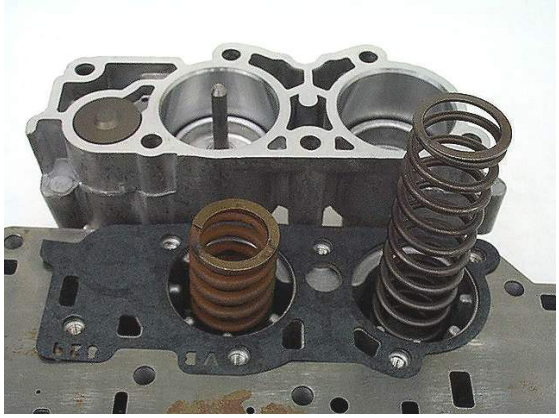
Step 9: On 2WD units, install a new orifice cup plug in the back of the case if the old seal is hardened or damaged, part number 8675516.

On 4WD units, the rear cup plug must be sealed off. If the case has an orifice cup plug, drill the hole in the plug to 1/8" and use a solid pop rivet to seal the opening.

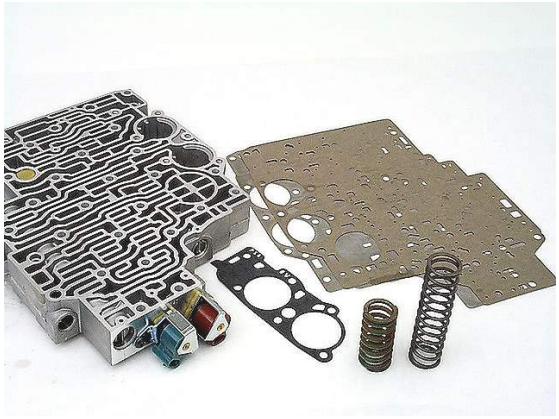
Step 10: The park pawl pin access hole in the case has been known to leak. Reseal it with silicone.

Valve Body and Accumulator Body

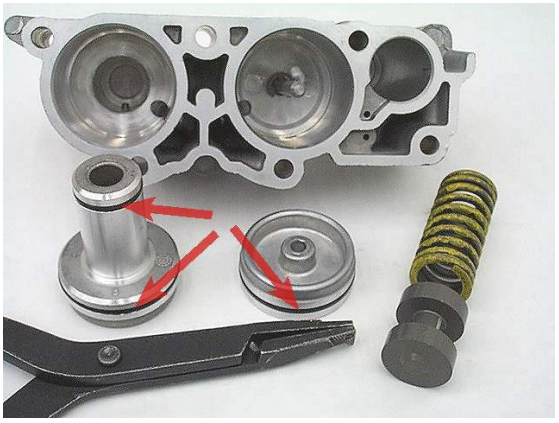
Step 1: Unbolt the accumulator body, and lift it off of the valve body.



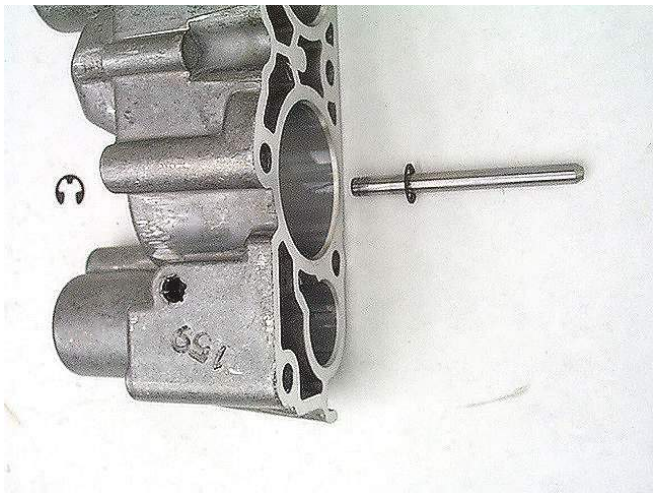
Step 2: Remove the accumulator springs and the separator plate.



Step 3: Remove the accumulator pistons from the accumulator body. Remove the sealing rings from the accumulator pistons.



Step 4: Remove the E-clip from the 4th accumulator piston, and lift the pin out of the accumulator housing.



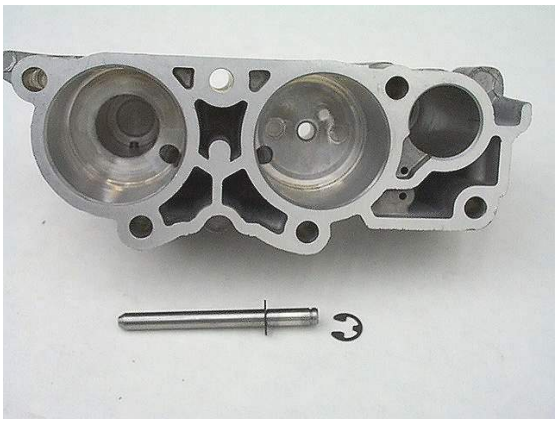
Step 5: Flat stone the accumulator housing surface to remove any nicks or burrs.

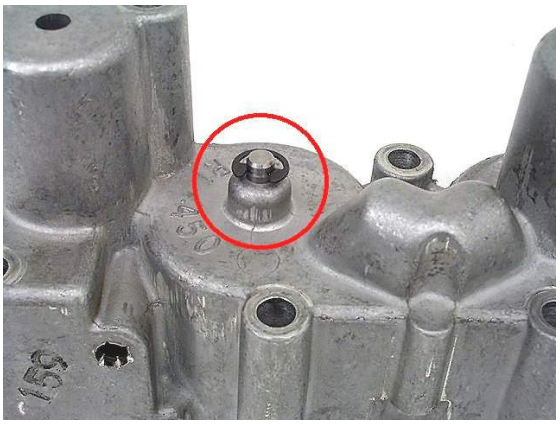
Step 6: Clean all accumulator components, and check for wear or damage:

- Check the accumulator body for cracks in the oil channels or wear in the accumulator bores.
- Check for wear in the 4th accumulator piston pin, or the pin holes in the accumulator or body.
- Check the accumulator pistons for wear, or cracks in the seal grooves.
- Check the springs for cracks, distortion or collapsing.

Step 7: Use a Scotchbrite pad to scuff the accumulator bores.

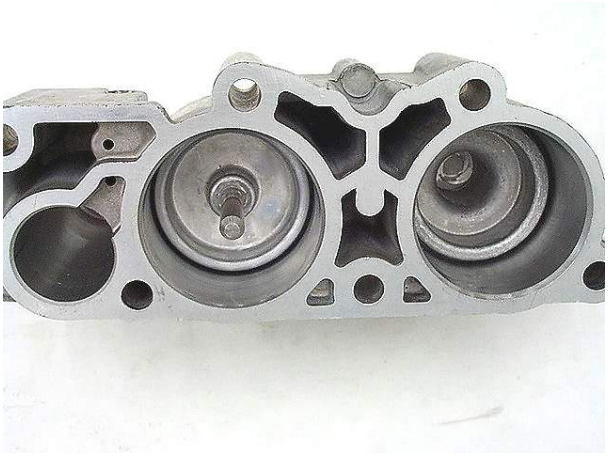
Step 8: Slip the 4th accumulator pin into the accumulator housing, and secure it with the E-clip.



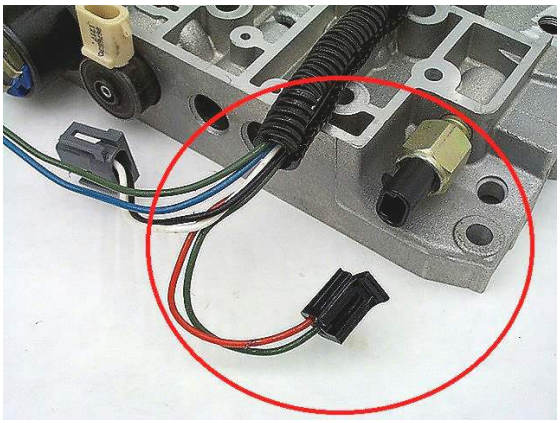


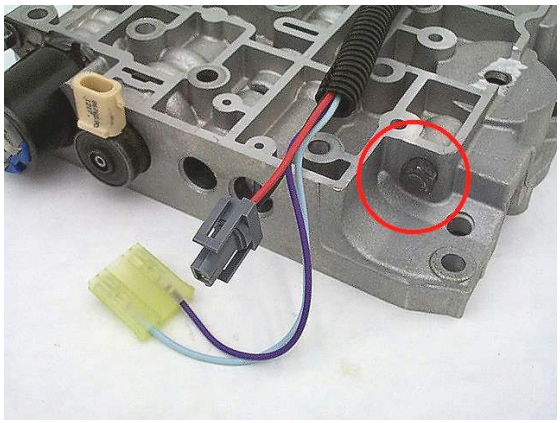
Step 9: Coat the new rubber accumulator seals with assembly lube, then install them on the accumulator pistons.

Step 10: Slide the accumulator pistons into the accumulator housing.

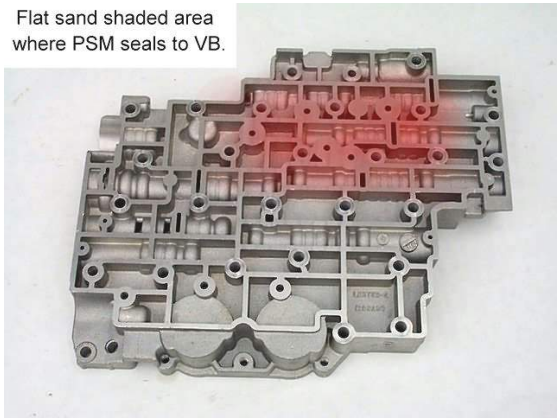


Step 11: Disassemble the valve body; remove the solenoids, valve trains and the pressure control solenoid filter. Discard the temperature switch, if so equipped, *making sure you plug the hole with a 1/8" pipe plug*. Be sure you install the replacement internal wiring harness, which includes a built in temperature sensor.





Step 12: Flat stone the valve body to remove any nicks or burrs.

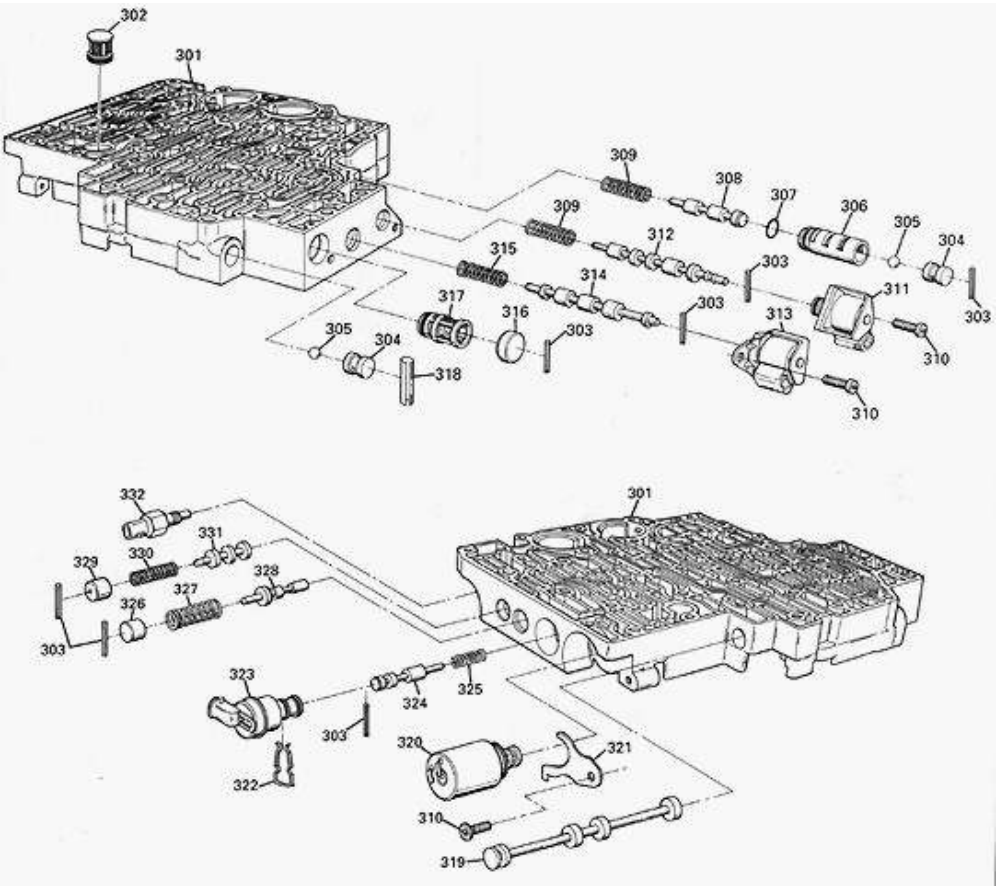


Step 13: Clean the valve body, valves and solenoids, and check for wear or damage:

- Check the valves for chips, wear, damage or bends.
- Check the valve springs for cracks, distortion or collapsing.
- Check the solenoids' resistance, and make sure they operate properly when you energize and de-energize them.
- Replace the shift valve fluid filter and pressure control solenoid fluid filter.

Step 14: Dip the valve body and valves in clean ATF.

Step 15: Reassemble the valve body — make sure the valve bore plugs seal properly.



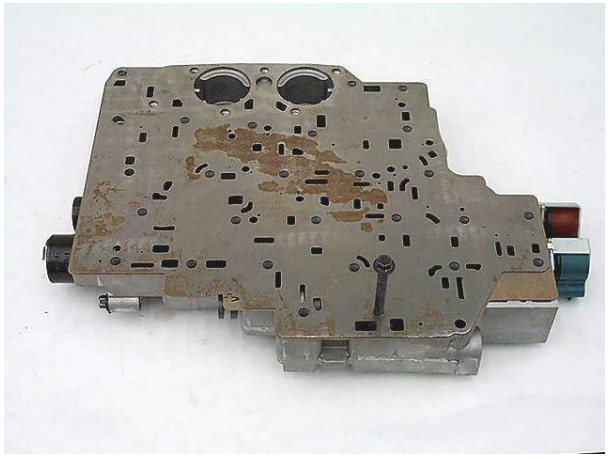
301 BODY, CONTROL VALVE
302 SCREEN FILTER, FORCE MOTOR FEED
303 PIN, COILED SPRING
304 PLUG, CHECKBALL
305 BALL (.375 DIA.)
306 BUSHING, 3RD/REVERSE CHECKBALL
307 SEAL, OIL PUMP CVR SCREEN
308 VALVE, 3/4 SHIFT
309 SPRING, SHIFT VALVE RETURN (2/3 & 3/4)
310 BOLT, SOLENOID (1/2 & 2/3 SHIFT, FORCE MOTOR)
311 SOLENOID & O-RING ASSEMBLY, 2/3 (B)
312 VALVE, 2/3 SHIFT
313 SOLENOID & O-RING ASSEMBLY, 1/2 (A)
314 VALVE, 1/2 SHIFT
315 SPRING, 1/2 SHIFT VALVE RETURN
316 PLUG, SHIFT SOLENOID FEED FILTER
317 FILTER, SHIFT SOLENOID FEED
318 SLEEVE, LO/REVERSE CHECKBALL
319 VALVE, MANUAL
320 VARIABLE FORCE MOTOR
321 CLAMP, FORCE MOTOR RETAINING
322 CLIP, PWM SOLENOID RETAINING
323 SOLENOID ASSEMBLY, PWM
324 VALVE, TCC REGULATOR APPLY
325 SPRING, TCC REGULATOR APPLY VALVE
326 PLUG, VALVE BORE (ACTUATOR FEED)
327 SPRING, ACTUATOR FEED LIMIT VALVE
328 VALVE, ACTUATOR FEED LIMIT
329 PLUG, ACCUMULATOR VALVE BORE
330 SPRING, ACCUMULATOR VALVE
331 VALVE, ACCUMULATOR
332 SENSOR, TEMPERATURE

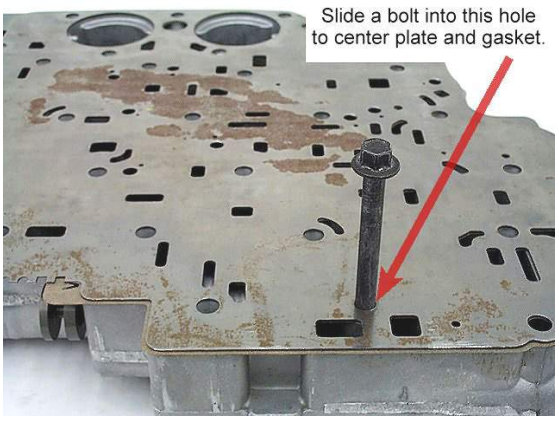
If the shift solenoids need to be replaced, make sure you use the latest solenoids available.

Step 16: Clean the separator plate, and check for wear or damage:

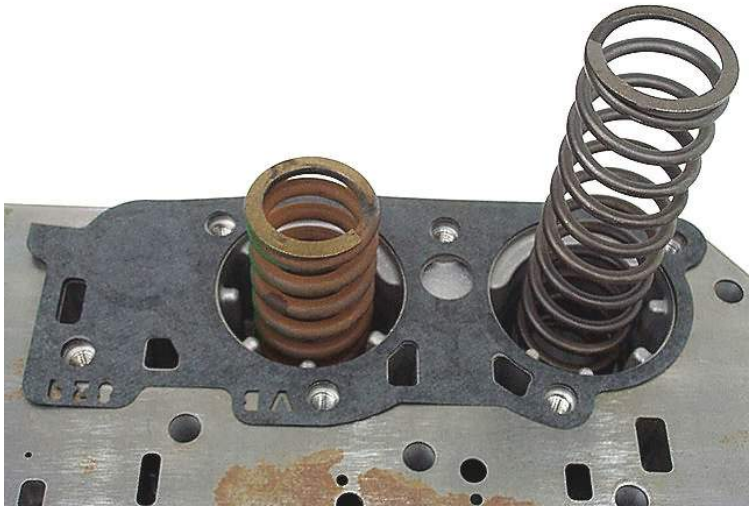
- Make sure you remove all of the gasket material.
- Make sure the plate is flat, with no burrs or chips.
- Check the checkball holes for excess wear; make sure the checkball seals properly.

Step 17: Lay the valve body gasket and separator plate onto the valve body.

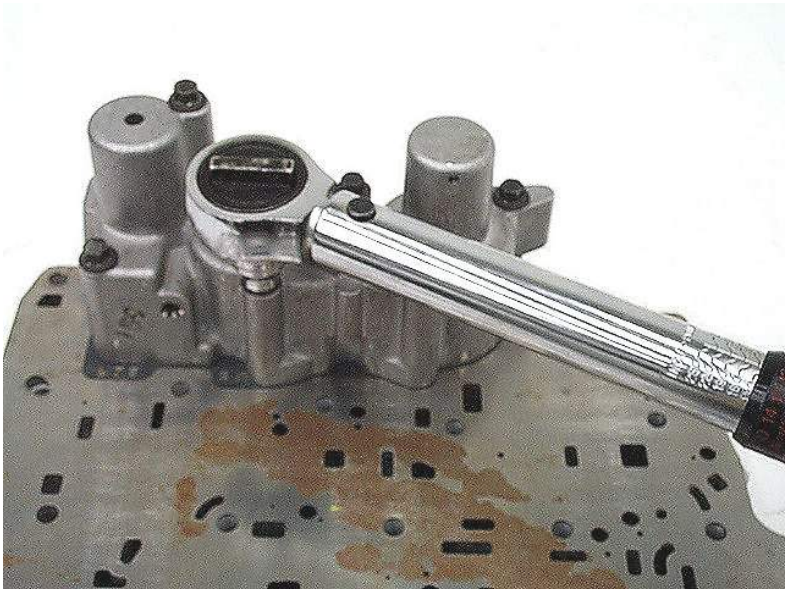




Step 18: Lay the accumulator gasket onto the separator plate. Set the accumulator springs onto the valve body — the smaller spring is for the 4th accumulator; the larger spring is for the 3rd accumulator.



Step 19: Lower the accumulator body into place, and thread the bolts in by hand. Torque the accumulator body bolts to 100 inch-pounds (11 Nm).



Step 20: Areas of special attention:

ATRA Technical Bulletin #317 covers problems caused by leaks at one of these two screens. Be sure to remove and check out both of these valve body screens for cracks. Always put new o-rings on them during any valve body service.

BULLETIN Technical

1995

Technical Bulletin #317

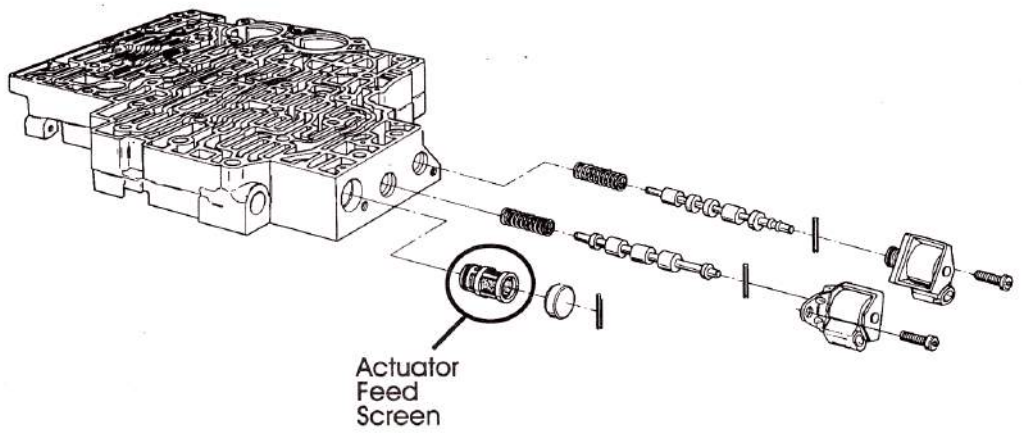
- Transmission: 4L80-E
- Subject: No shifting, scanner reports shifting
- Application: GM

4L80-E

Scanner Reports Shifting But Transmission Does Not Shift

A condition where no upshifts occurs, but a scanner report shows that the computer is shifting the transmission, can be caused by a broken or leaking actuator feed screen.

When this screen breaks or leaks, solenoid feed oil is drained into the sump. This will result in second gear only. The part number for the screen is 8661709.



A shift from 3rd gear into neutral might be corrected by increasing solenoid B feed oil. ATRA Technical Bulletin #333 shows how and where.

BULLETIN Technical

ATRA

1996

Technical Bulletin #333

- Transmission: 4L80-E
- Subject: Neutrals on the 3-4 upshift
- Application: GM Trucks

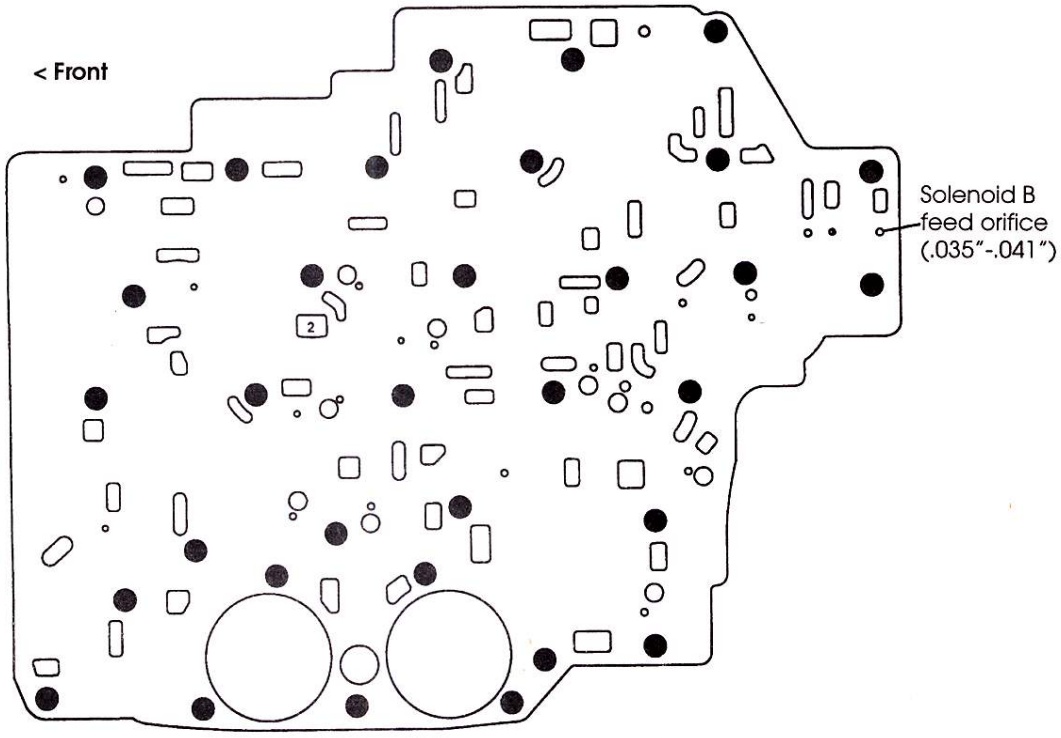
4L80-E

Neutrals on the 3-4 Upshift

This symptom may be caused by a leak in the solenoid B circuit. It is not uncommon for the feed circuit for shift solenoid B to supply too little oil. When this happens, and solenoid A closes for the shift to fourth, solenoid B pressure can not continue to hold the 1-2 shift valve in the shifted position. The transmission is actually making a 1-2-3-1 shift which feels like neutral.

NOTE: *Because the computer still commands fourth gear when the manual lever is in manual third, this condition will still occur in manual third.*

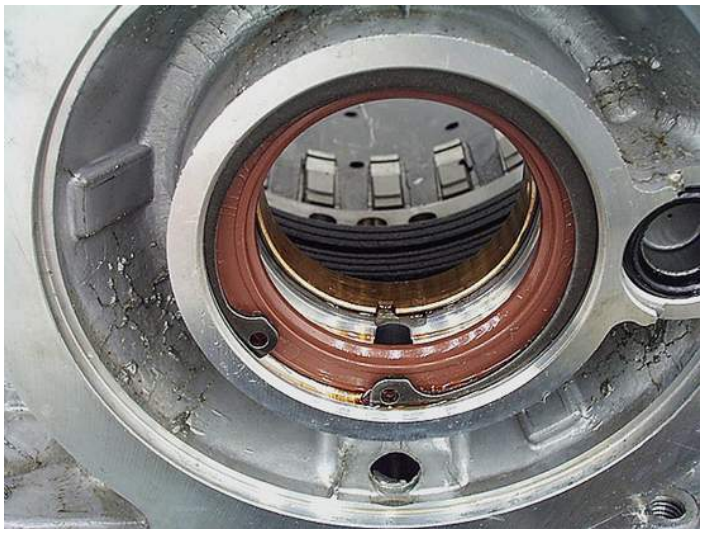
If the leak cannot be found (damaged solenoid B o-ring, solenoid B doesn't close fully when energized, etc.) drill the shift solenoid B feed orifice to .035"-.041"



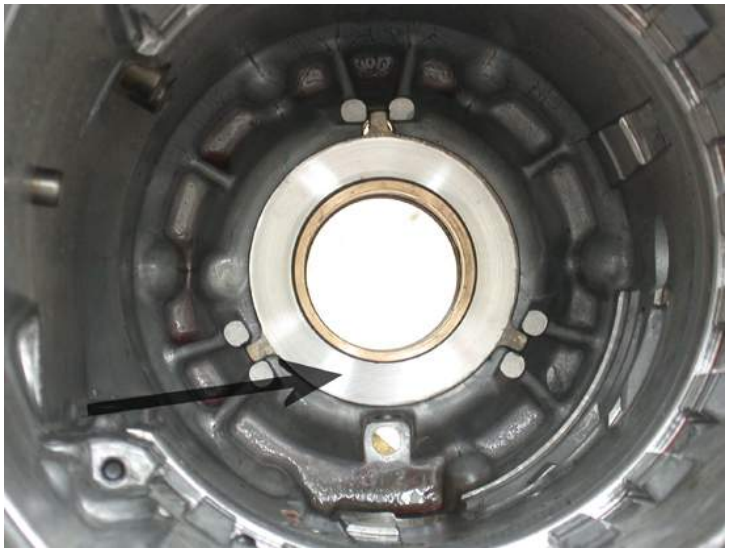
Transmission Assembly

Always soak friction clutches in clean ATF for at least 20 minutes before installing the clutches in the transmission.

Step 1: (4WD only) Install a new output shaft seal in the back of the case, and install the seal retaining snap ring. Coat the seal with assembly lube.



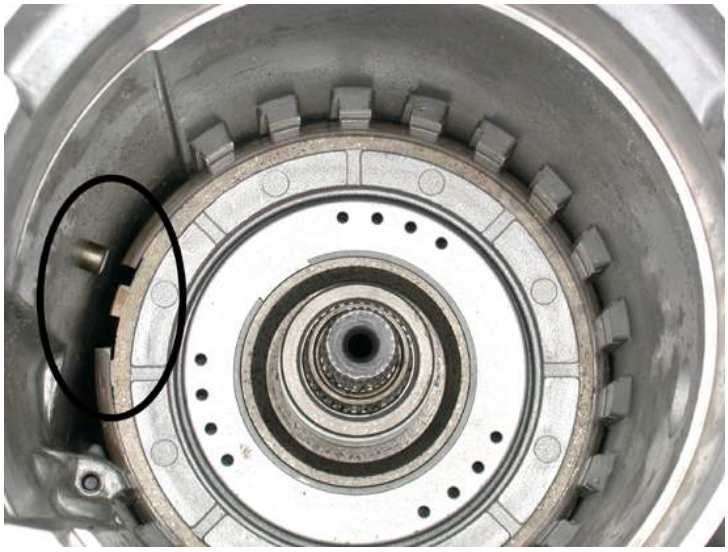
Step 2: Set the output shaft selective thrust washer in the back of the case. Use assembly lube to hold it in place.



Step 3: Install the low/reverse band into the case, making certain that the two pockets on the end of the band engage the two case lugs. Install the thin center support spacer/snap ring into the case, in the groove just above the low/reverse band. Make sure the opening in the snap ring faces the 9 o'clock position as you're looking into the case.

Step 4: Lower the center support and gear train assembly into the case. Align the lugs in the center support with the lugs in the case, and make sure the threaded hole in the center support aligns with the bolt hole in the case.

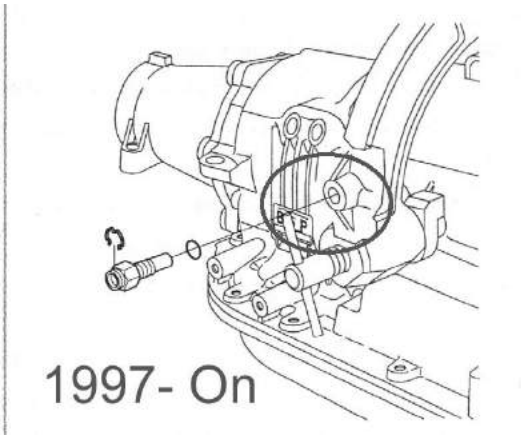
Step 5: Use a screwdriver or small prybar to rotate the center support counterclockwise against the case lugs. Install the center support snap ring, with the opening facing the 9 o'clock position.



Step 6: Prior to flipping the unit over for this step, you might want to remove the sun gear shaft from the gear train to keep it from banging your toe a good one when you flip the unit over. Use a dial indicator to check the output shaft endplay — it should be between 0.005" – 0.025" (0.130 – 0.635 mm). If the endplay is outside of specs, replace the selective thrust washer with a different thickness washer and recheck the endplay.

Step 7: Thread a new center support bolt into the center support by hand. Torque the retaining bolt to 32 foot-pounds (43 Nm). Make sure the bolt seats against the bottom of the case.

Step 8- Units with front and rear cooler line fittings: Install a new washer on the rear cooler fitting, and thread the fitting into the case. Torque the fitting to 26 foot-pounds (35 Nm).



Step 9: Install the intermediate clutches in the case. Late model units may start with a wave plate underneath the first steel plate. Alternate the plates: steel, friction, steel, etc. There should be four frictions and four steels. Then install the pressure plate and snap ring.

Step 10: Use a feeler gauge to check the clearance between the intermediate clutch pressure plate and snap ring. The clearance should be between 0.040" and 0.110" (1.00 – 2.70 mm). If the clearance is wrong, replace the pressure plate to bring the clearance into specs.

Step 11: Install the Manual 2 brake band into the case. Make sure the band end engages properly with the anchor pin.

Step 12: Temporarily install the forward drum pressure plate/flange into the direct drum. Leave one end of the pressure plate snap ring sticking up out of the groove. Coat the drum's seal ring bore with assembly lube. Lower the drum into the case while using a screwdriver to wiggle the band so that the drum can slip through it without binding. Work the direct drum's sprag race down through the intermediate clutch teeth by rotating the drum back and forth. You'll know that the drum is fully seated when you can rotate it fairly easy in both directions while pressing down on it. Once the drum is seated, replace the forward drum flange and plate with the direct clutch pressure plate.

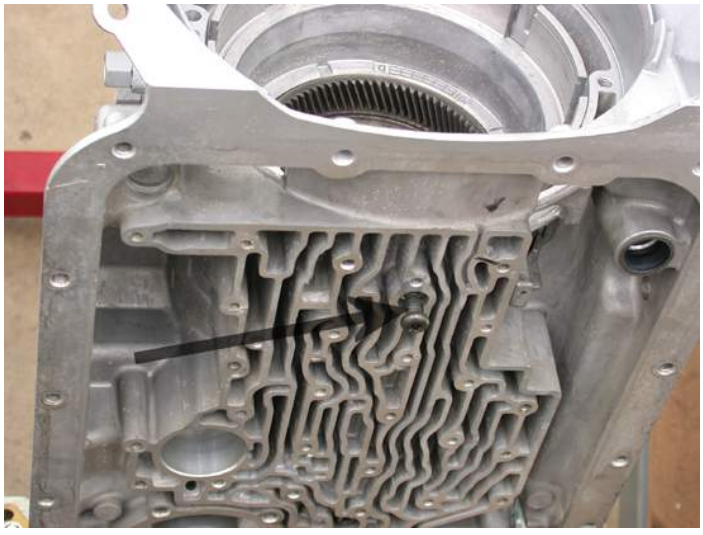
Step 13: Prepare to install the forward clutch. If the forward drum pressure plate was used to install the direct drum, be sure that it is back in the forward drum. Make sure the plastic thrust washer is in place on top of the forward clutch hub.

NOTE: The plastic thrust washer may have already been replaced by a metal thrust washer just like the one under the hub. This is an acceptable replacement.

Lower the forward clutch into the transmission. Work the forward drum flange through the direct clutch teeth. To help the drum engage the clutch teeth, pull upward on the drum just enough to take a little of the drum's weight off of the clutch teeth. You'll know that the drum is all the way down where it belongs by lifting the drum just a little bit (about 1/16") and dropping it. You should hear a distinct metal-to-metal 'clunk' when the forward drum hits the direct drum.

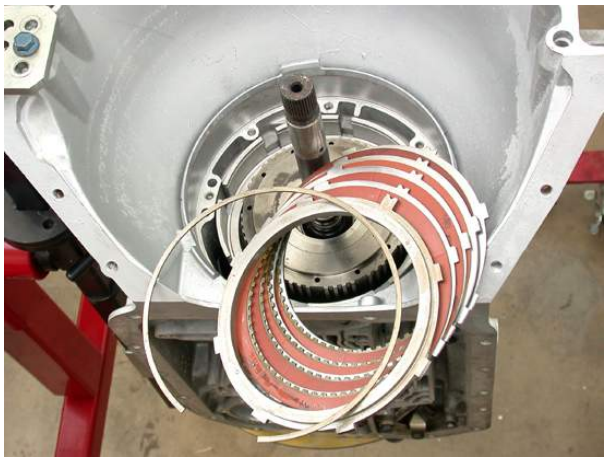
Step 14: Install the thrust bearing onto the forward clutch drum, with the silver side facing up as shown. Use assembly lube to hold it in place.

Step 15: Install the 4th clutch housing into the transmission case. Thread a new retaining bolt in through the bottom of the case, and torque it to 17 – 19 foot-pounds (23 – 26 Nm).

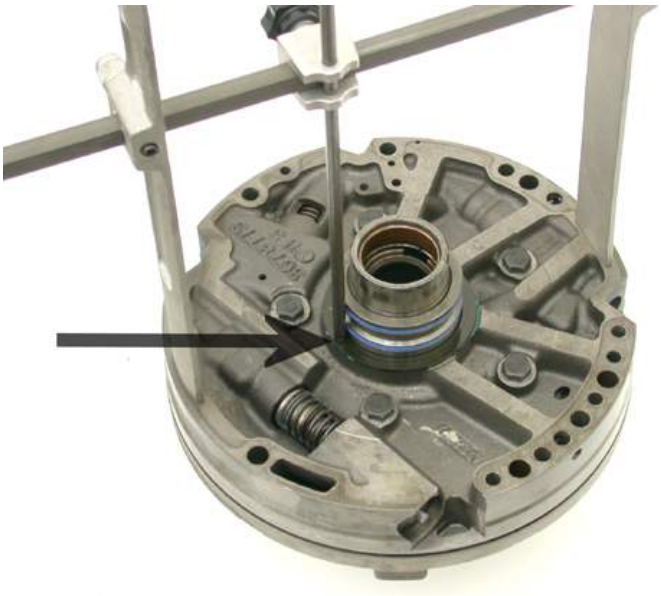


Step 16: Install the overdrive assembly into the case. When installed properly, the overdrive assembly should sit even with the 4th clutch assembly.

Step 17: Install the 4th clutches into the 4th clutch housing, starting with a steel plate, and alternating friction, steel, friction, etc. There should be four frictions and four steels. Install the clutch pack, making sure that the steel plate lugs with the "V" on the end are facing the 1 o'clock position. Install the 4th clutch pressure plate and snap ring.



Step 18: Use an 'H Gauge' or similar device to check the front end play. IMPORTANT NOTE- The rear geartrain unit must be loaded forward (up) in order to properly and accurately check front end play. Temporarily standing the unit up onto the output shaft should sufficiently load the rear unit. Proper clearance is from .004" to .022". This is adjusted by using the proper thickness front pump thrust washer. To check the clearance, first zero the H-gauge on the case and overdrive assembly. Then flip the gauge over onto the rear face of the pump and measure the clearance between the gauge rod and the selective thrust washer.

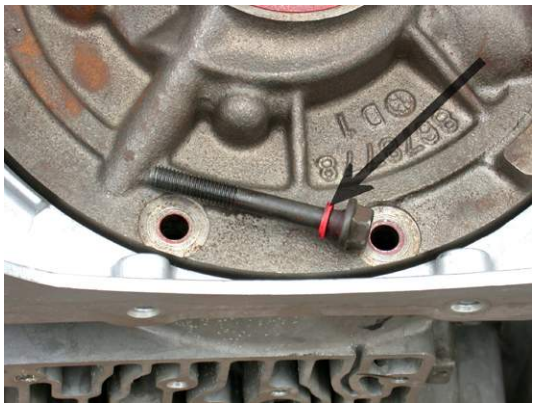


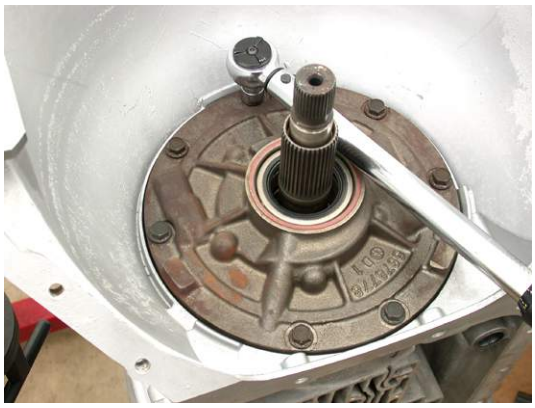
If it’s a close call between two washer sizes, choose toward the thicker washer because the pump gasket will give you just a little more room than your measurement indicated.

Step 19: Install pump guide pins to help line up the pump with the case. You can make them by cutting the heads off of a couple of long bolts that thread into the pump bolt holes. Cut a screwdriver slot into the cut end of the bolt to help you remove them.

Step 20: Lay the pump gasket in place on the transmission.

Step 21: Carefully slide the pump assembly into the transmission. Work the pump down all the way by hand. Make sure the turbine shaft will rotate freely with the pump in place. Install new pump bolt o-rings on the pump mounting bolts, and thread the pump bolts in by hand. Torque the pump bolts to 18 foot-pounds (24 Nm).



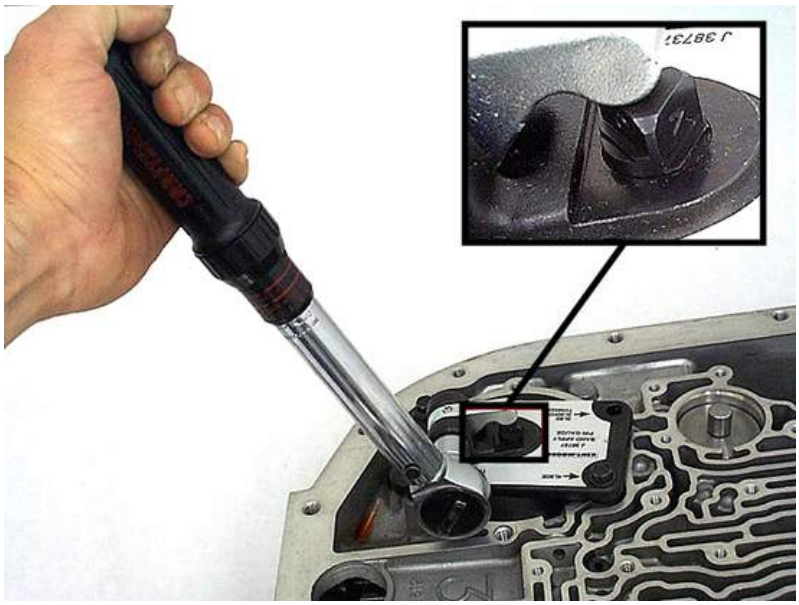


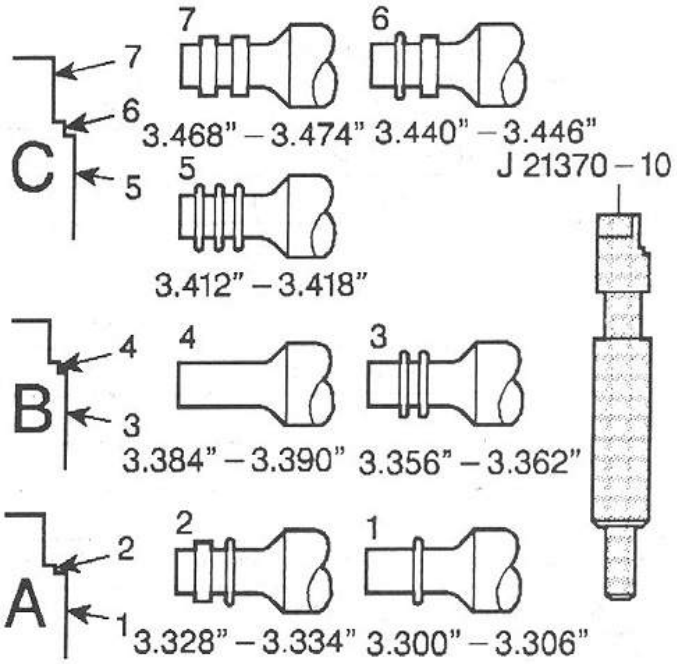
Step 22: Place a new TCC o-ring into the groove on the turbine shaft as shown and coat it with assembly lube.

Step 23: Install and lubricate the new seal for the Manual 2 Brake Band servo. Place the spring and seat into the case bore. Using assembly lube to hold the e-clip in place on the servo pin, slide the servo into the transmission case. Make sure the servo pin engages with the band and can apply it.

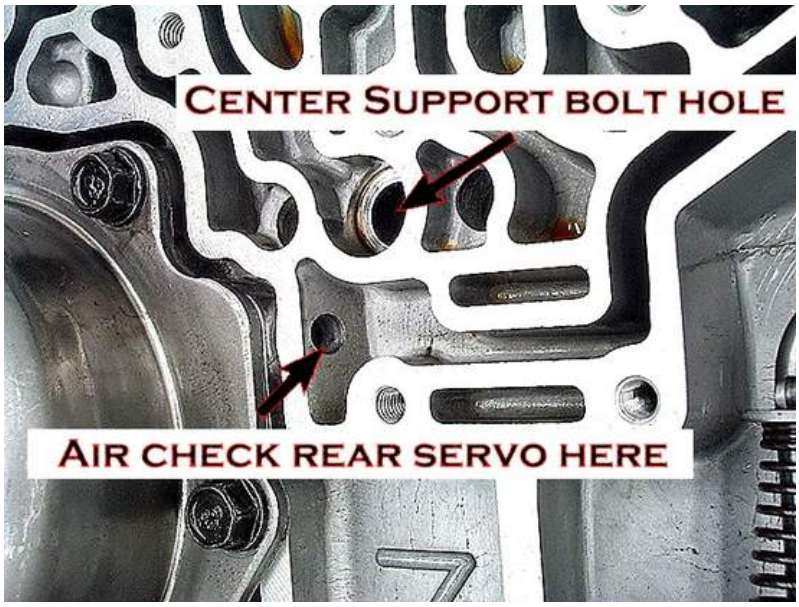
Step 24: If the case, rear band or rear planet has been changed, or there are reverse engagement or Manual 1 engine braking problems, check the low/reverse servo pin adjustment as follows:

Mount the adjustment tool onto the case. Use a torque wrench to apply 25 foot-pounds (34 Nm) torque to the hex nut on the side of the tool. Check the lands on the side of the adjustment pin to see which land is flush with the tool base. Compare the land position to the illustrations in the chart to determine which servo pin to use.



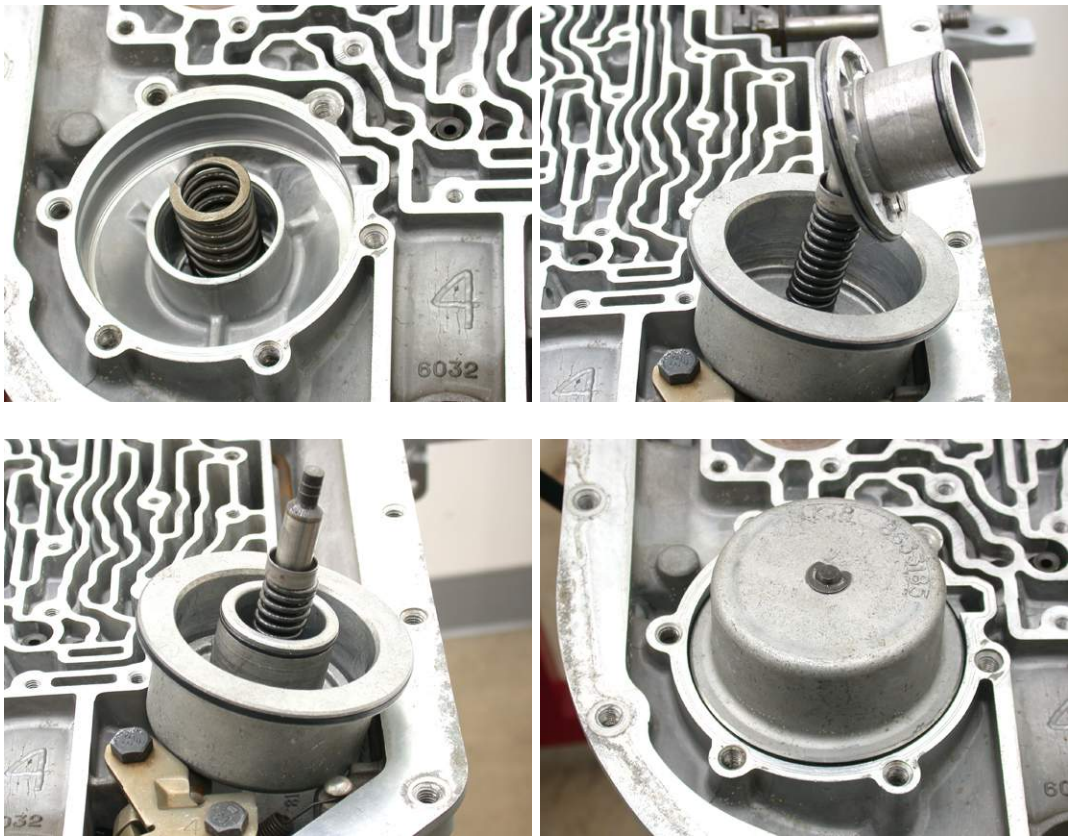


Another method of checking servo travel is to install the servo into the case after installing the rear band and gear train up to the front planet assembly, but without the center support, or anything forward of the center support installed. Air check the servo using 100-150 psi, making sure that the servo pin travels approximately 3/16".

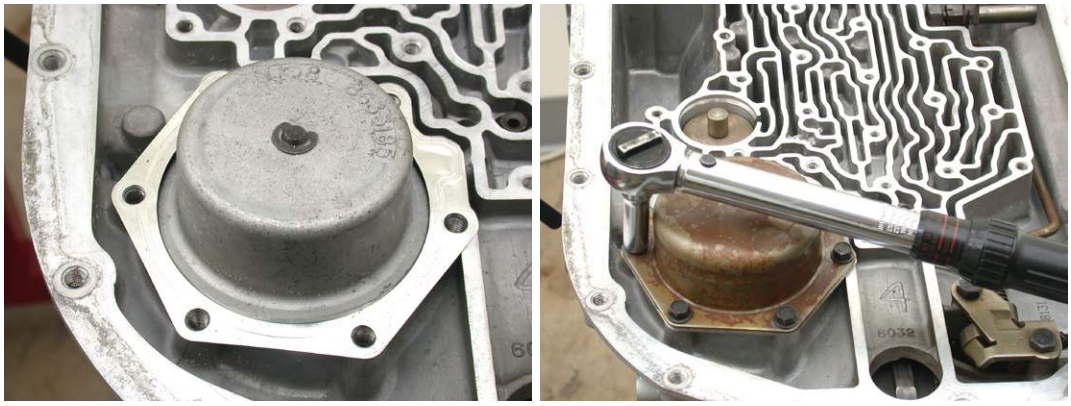


If the pin in the low/reverse servo is correct, use it; if not, replace the pin with the correct length pin.

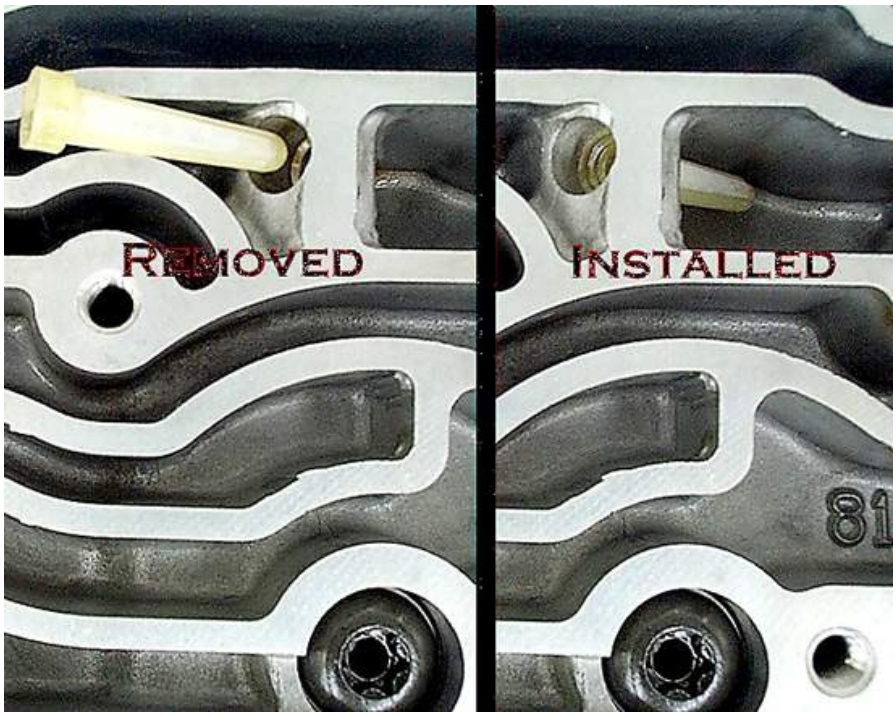
Step 25: Lubricate the low/reverse servo bore in the case. Set the servo return spring into the case. Install the new 1-2 accumulator piston seals, then install the 1-2 accumulator piston into the low-reverse servo piston. Install the new low-reverse piston seal onto the piston, then slide the servo piston into the case bore.

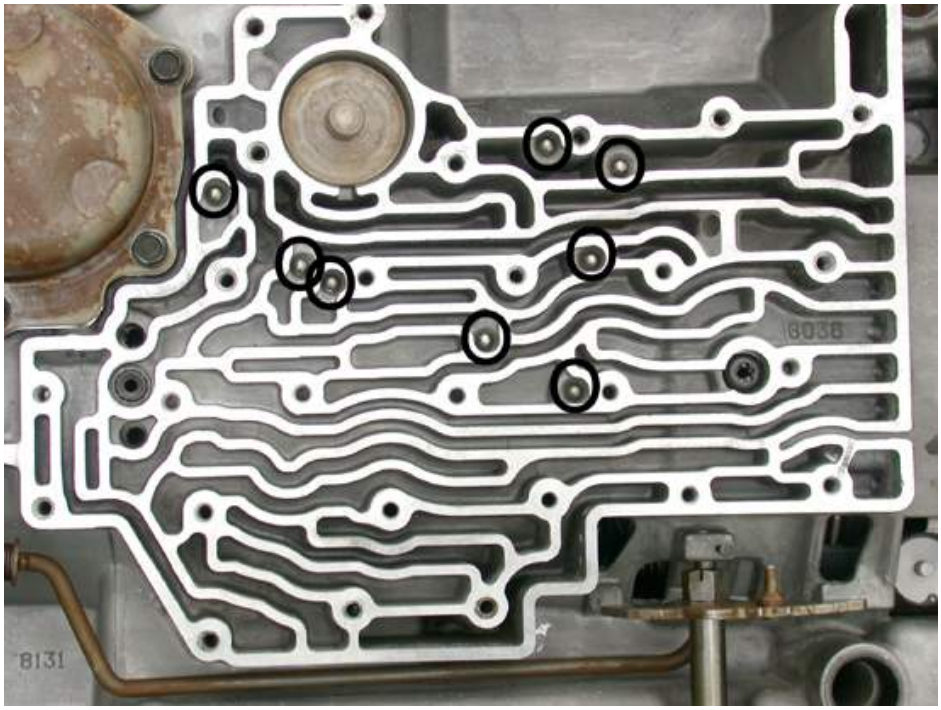


Step 26: Lay the low/reverse servo cover gasket in place, and set the cover onto the gasket. Thread the bolts in by hand, and then torque them to 18 foot-pounds (24 Nm).



Step 27: Install the PWM screen into the proper case channel near the fourth clutch housing bolt, then install the checkballs into the case pockets.





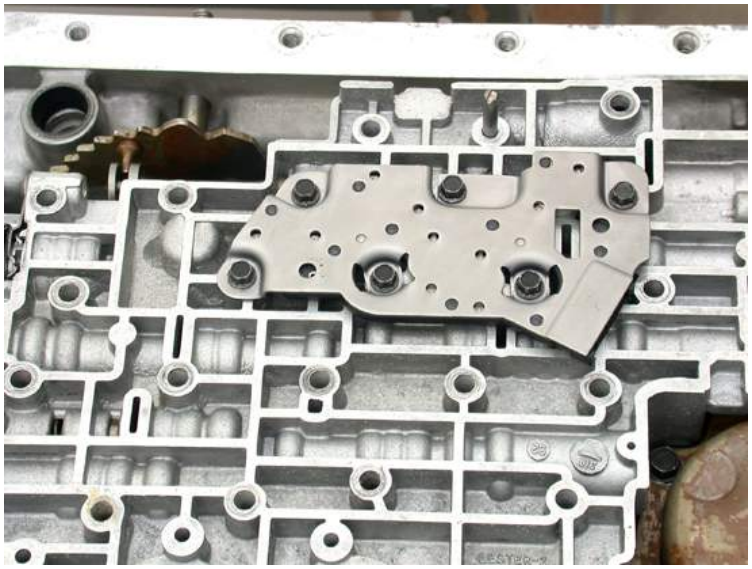
Step 28: If you have valve body alignment pins, install them now.

Step 29: Place the case gasket into position on the transmission case.

Step 30: Lay the valve body onto the transmission. Make sure you align the manual valve with the manual lever while installing the valve body.

NEED SHOT!!!

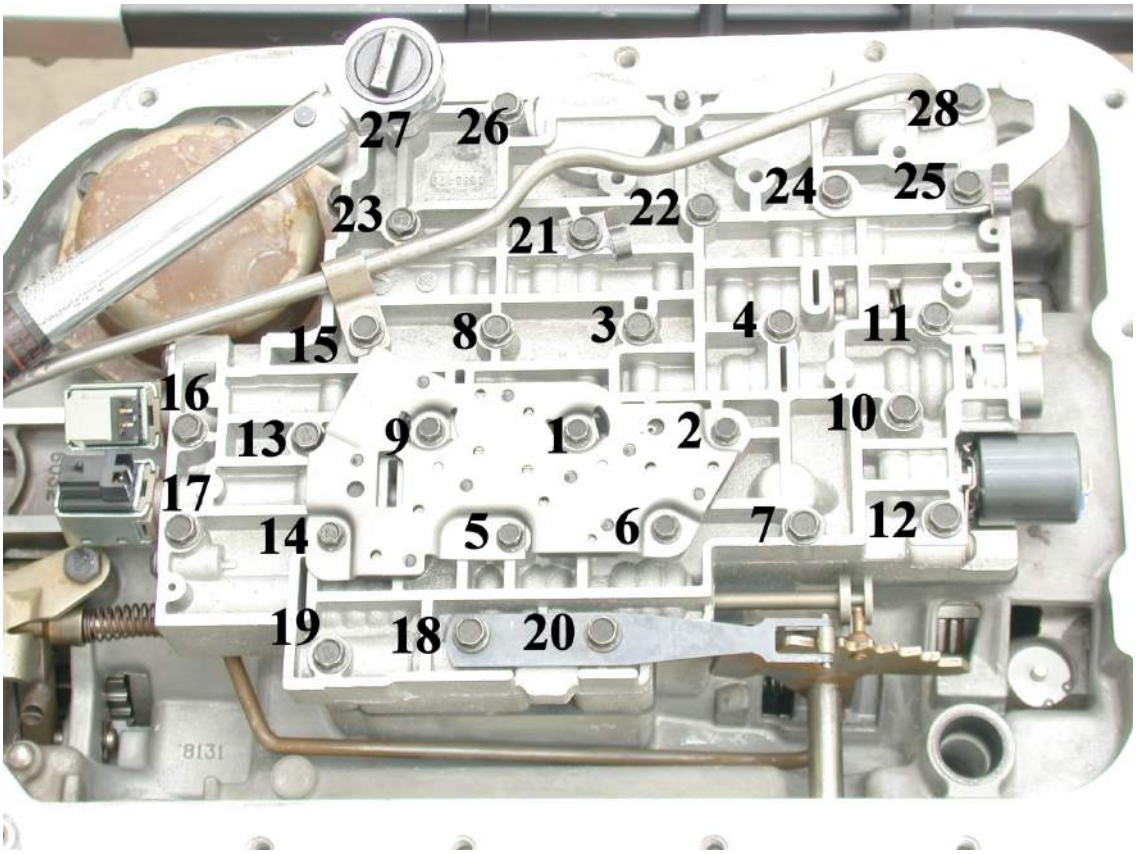
Step 31: Install the pressure switch manifold on the valve body, making certain that all switch membranes and o-rings are intact and in position. Install the bolts, but leave them only finger-tight until the rest of the valve body bolts are installed.



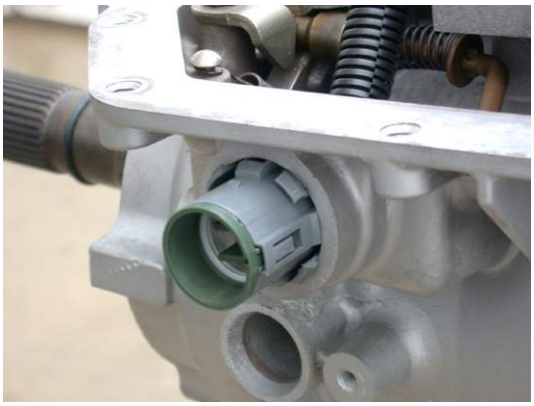
Step 32: Install the lube tube, detent roller and spring, and all wire clips on the valve body. This illustration shows the valve body bolts that hold down the lube tube, pressure switch manifold, small part retainers, détente springs, wire harness guides, etc. In other words, these are the valve body bolts that **also** hold other small parts. Start these bolts and the parts they retain into their holes first. Thread the bolts by hand or gently with a speed handle to avoid bolt thread damage from a slightly misaligned separator plate. Leave each bolt about one half turn loose at this stage.

Step 33: Install the remaining valve body bolts, leaving them at least ½ turn loose until all bolts are threaded into position. Switching back and forth between an 8mm and a 10mm socket, torque all valve body and pressure switch manifold bolts to 100 inch-pounds (11 Nm) using a circular pattern, starting from the center and working your way out. The image below is one suggested pattern you can use, but always keep in mind:

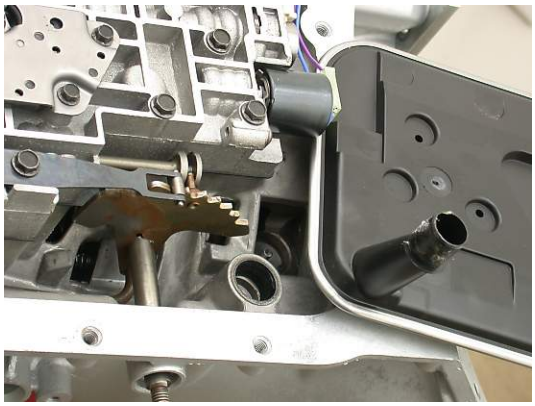
- Torque the bolts in stages. Initially go through the complete pattern torquing the bolts to 70 in/lbs.
- Repeat the pattern, going up to 90 in/lbs.
- Run the pattern again to the final torque of 100 in/lbs.
- Repeat the pattern once more at 100 in/lbs to compensate for gasket crush, which makes sure that the valve body is tightened evenly and kept nice and flat.



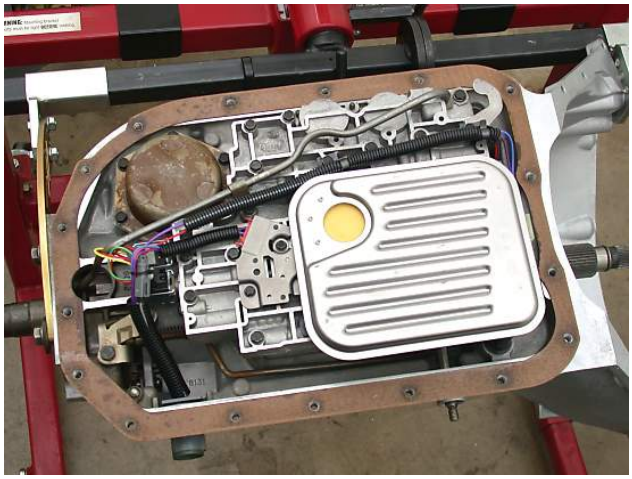
Step 34: Install a new O-ring on the wiring harness plug, and lubricate it with assembly lube. Slide it into the opening of the case, until the tabs lock in place. Plug the connectors into the solenoids and switches, paying very close attention to wire routing to avoid pinching wires when the filter is installed and the pan is bolted down.

Step 35: Install the transmission filter seal (if you haven't yet), then coat the filter neck with assembly lube and install the filter.




Step 36: Lay the pan gasket onto the transmission pan surface.



Step 37: Clean and install the magnet into the pan. Place the pan on the transmission. Thread the pan bolts in by hand. Torque the bolts to 18 foot pounds (24 Nm).


Step 38: Install a new o-ring on the transmission speed sensors, and install them in the case. Tighten the bolts just good ‘n’ snug with a short wrench or speed handle.


Step 39: While you’re in this area, go ahead and install the shift lever now if the unit came to you with one.

Step 40: If the unit uses an o-ring on the output shaft, install it now and coat it with assembly lube.

Step 41: On two-wheel drive units, place the extension housing o-ring on the extension housing. Slide the extension housing onto the transmission case, and thread the bolts in by hand. Torque the bolts to 25 foot-pounds (34 Nm). This transmission is ready to install.